SCIENTIFIC AMERICAN

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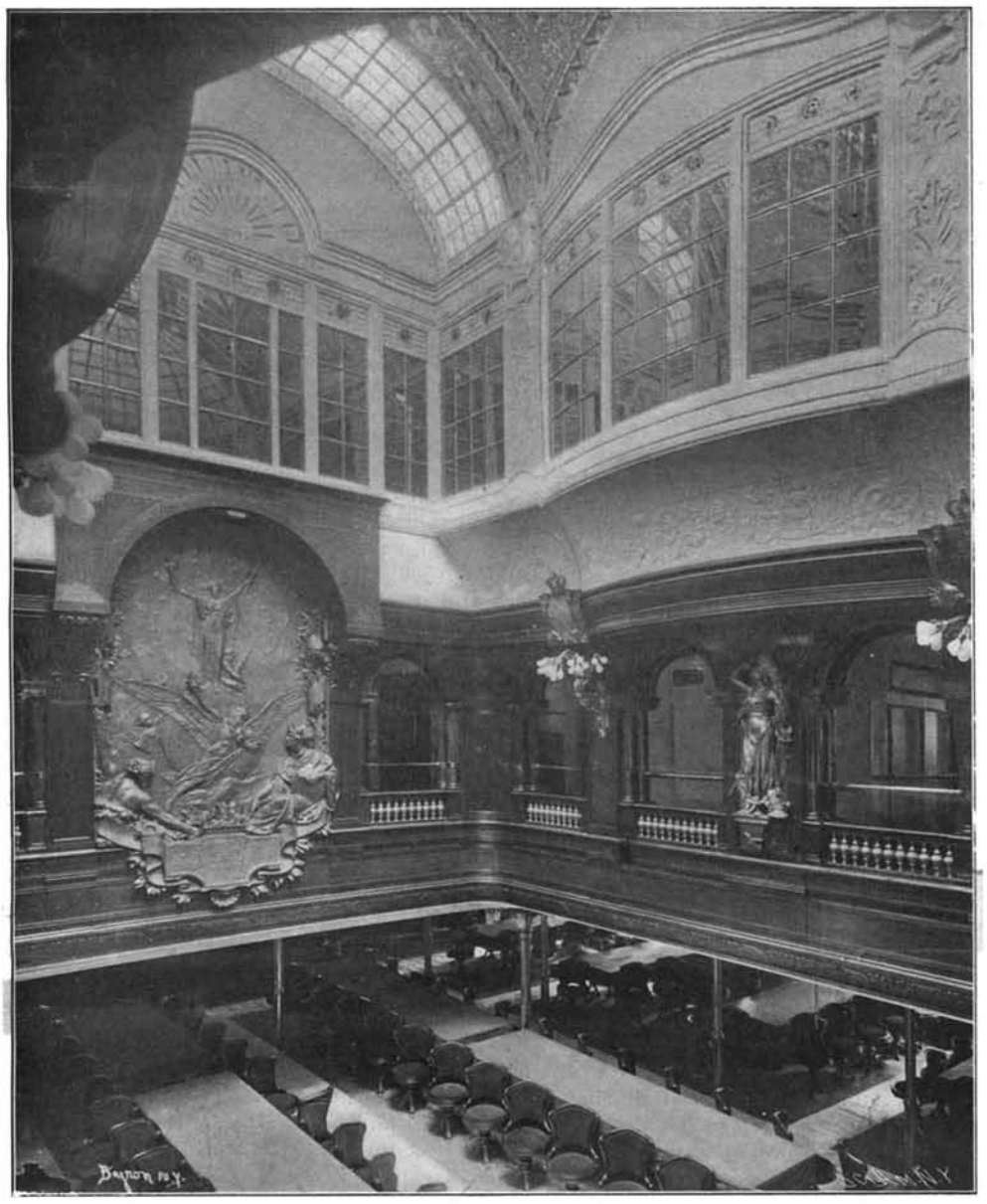
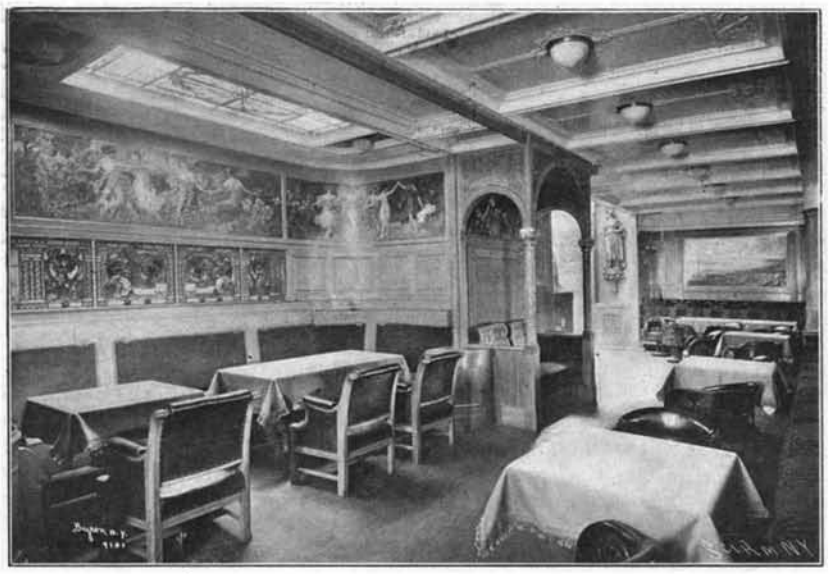
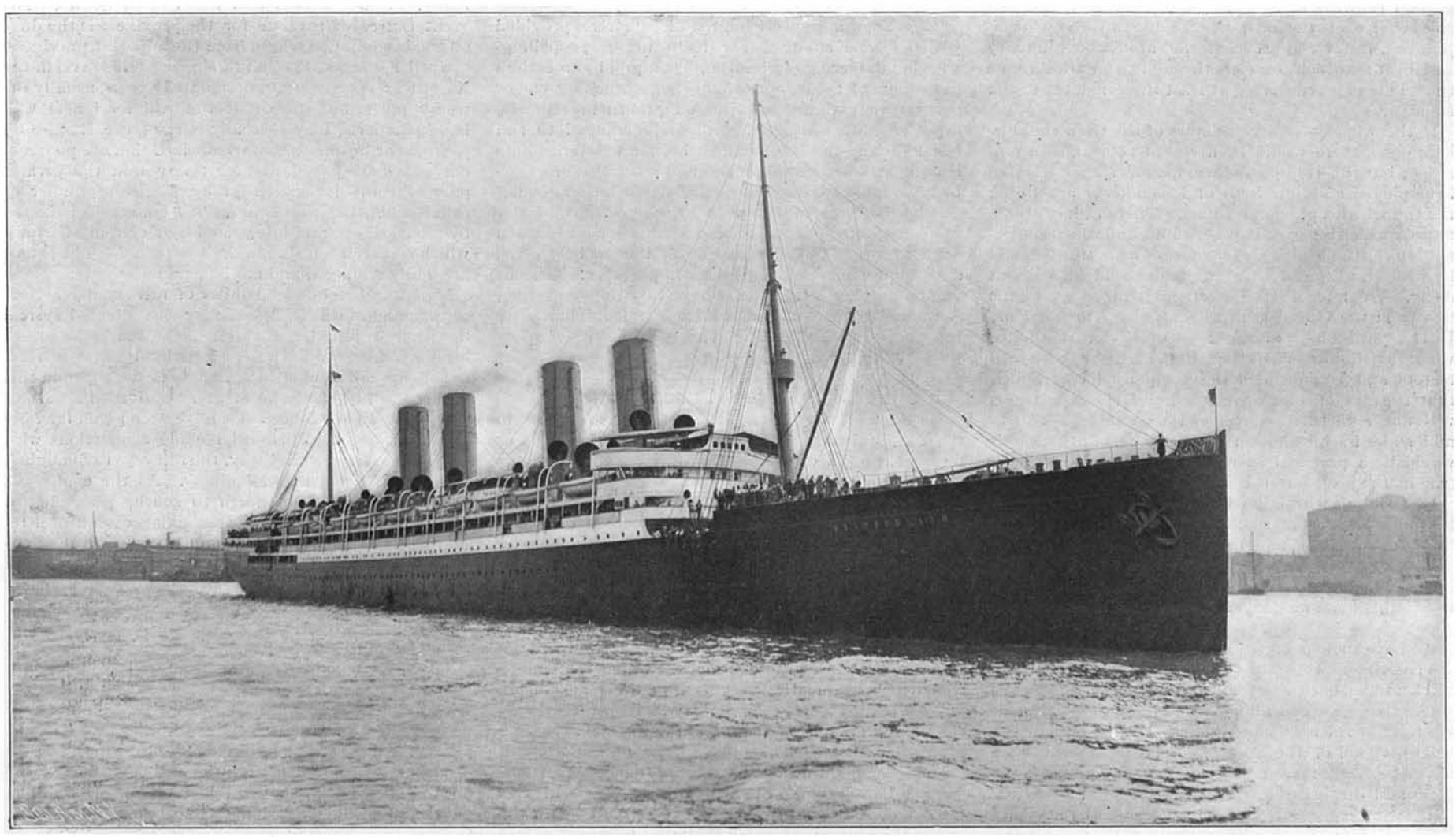


Looking Down into Main Dining Saloon from the Gallery. This View Includes Three Separate Decks.



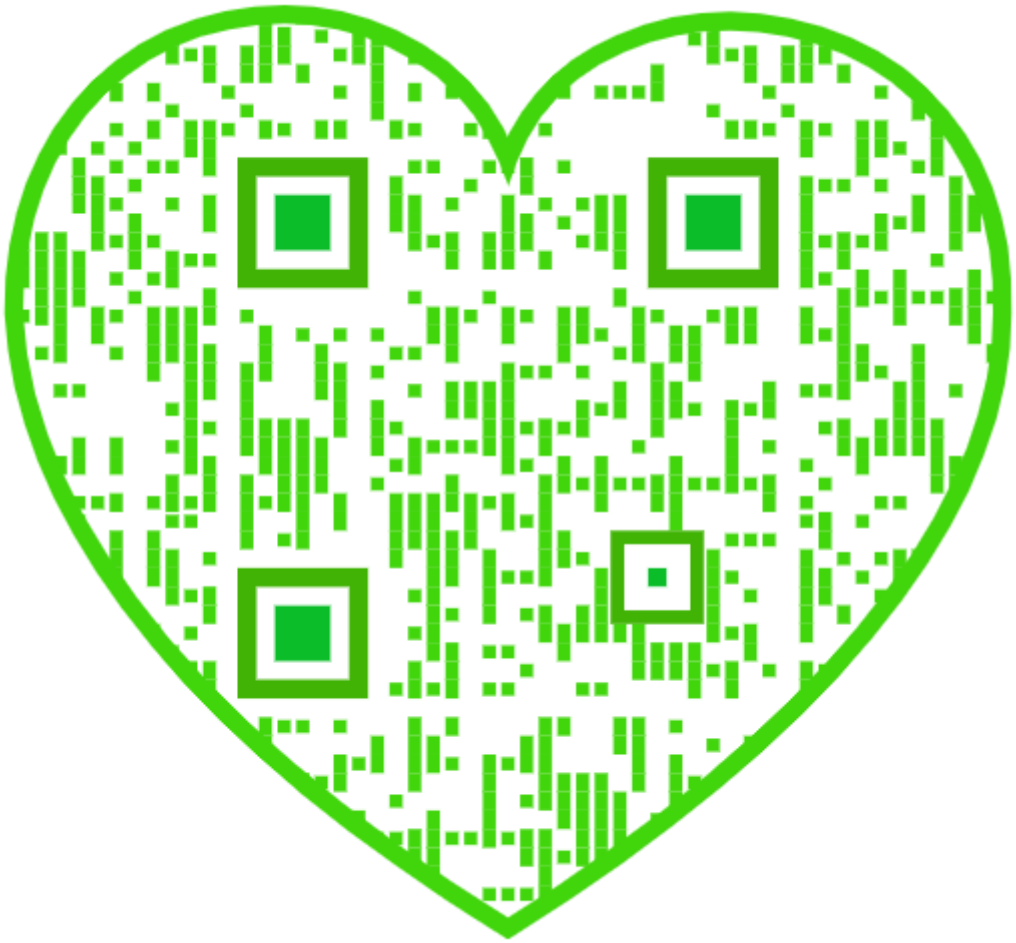
A Corner in the Smoking Room.

The Grill and Bar on the Boat Deck.



Length, 686 feet **Beam,** 67 feet. **Displacement,** 23,000 tons. **Indicated Horse Power** (average from New York to Plymouth), 35,640. **Speed,** 23 knots.

NEW HAMBURG-AMERICAN LINER "DEUTSCHLAND," HOLDER OF TRANSATLANTIC RECORD.—[See page 72.]



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NEW YORK, SATURDAY, AUGUST 4, 1900.

ELECTRICAL EQUIPMENT OF THE PARK AVENUE TUNNEL.

The New York Central Railway Company is just now engaged in carrying out much needed improvements in their New York terminal station at 42d Street, and it is probable that before winter there will be placed at the disposal of the public waiting-room and other terminal facilities, which will be fully up to the standard set by the leading railroad companies of the world. Now, that the directors have remedied one great defect at this station, it will be the earnest hope of the traveling public that they will take in hand another and even more serious drawback, which is painfully evident to every one who enters or leaves New York City over the lines of the New York Central, or the New York, New Haven and Hartford Company. We refer to the two miles of tunnel beneath Park Avenue which forms the approach to the Grand Central Station. The tunnel is, at all times, a source of inconvenience to the traveling public, and it is not stretching the point too far to say that during two or three months of the year it is atrociously uncomfortable. It is not an uncommon occurrence, during the summer months, when the temperature is between 90° and 100° in the shade, and the humidity near the saturation point, for outgoing and incoming trains to be stopped by signal within the tunnel itself. This delay, we are willing to believe, is not due to any carelessness or poor management on the part of the railroad company, but to the fact that an enormous amount of travel and switching of trains has to be accommodated in a yard that is altogether too small to accommodate it. Whatever the cause, the fact remains that every day crowded trains are delayed in the tunnel, sometimes for several minutes together, when the cars, owing to the sulphurous gases with which the tunnel is filled, have to be tightly closed. The resulting temperature and atmosphere within the cars is positively unique. It can scarcely be equaled, and certainly cannot be surpassed, on any railroad in the world. The nearest approach to it, is, or rather was (for they have made the necessary change to electricity), on the underground railways of London; but there is this difference, that while the air in the London railways was sulphurous, it never approached the intolerable humidity and heat to which travelers through the Park Avenue tunnel are exposed during at least three months of the summer.

If the windows and ventilators of the train could be kept open, there would be a considerable measure of relief; but this is impossible so long as steam traction is employed and hundreds of locomotives are filling the tunnel with poisonous fumes. There is, however, a remedy which is perfectly practicable, and which consideration for the health and comfort of its patrons should lead the New York Central Railroad to adopt without delay. We refer to the electrical equipment of the line from the Grand Central Station up to the Mott Haven yards, beyond the Harlem River. Hitherto, when this improvement has been suggested, the directors and engineers of the company have replied that the art of electrical traction for heavy trains was not sufficiently developed to enable them to undertake its installation with any certainty that it would be a practical success. That may have been true in the past, but it is not true to-day. The success of electrical traction in the Belt Line tunnel at Baltimore, on certain sections of the New Haven Road itself, and in the underground tunnels of London, proves that the day has come when the New York Central Railroad Company may safely undertake a work which can no longer be regarded as an experiment.

We have spoken of the extraordinary discomfort to the passengers who pass to and from the Grand Central Station; but there is another section of the public whose claims are too numerous and just to be ignored. We refer to the residents in Park Avenue and in the neighborhood of the Forty-second Street yard, who have a perfectly reasonable ground for complaint in the noise and dirt occasioned by the continual switching that is inseparable from the handling of the immense amount of traffic that enters this station. All the smoke and dust and most of the noise, attached to the present system of switching with steam locomotives, would be avoided by the use of electric traction; and while the equipment of this yard with its complicated cross-overs and switches would be a matter calling for considerable thought and skill, there is no reason to suppose that it is beyond the power of any first-class electrical engineer of to-day.

AN IMPORTANT PATENT SUIT.

On May 8, 1879, an application was filed by George B. Selden, of Rochester, N. Y., for a patent on a "road locomotive," the power of which was derived from a hydrocarbon-motor. For years the specification and drawings remained in the Patent Office; and not until November 5, 1895, were letters patent finally issued. The long interval between the filing of the application and the granting of the patent, although remarkable, is not uncommon; for interference proceedings or shrewd maneuvering on the part of attorneys may delay the issuing of the patent. Had Selden received a patent in 1879, he could hardly have derived any benefit from the practical application of his invention, in view of the state of the motor-carriage industry at that time. As it is, however, his invention promises to give automobile manufacturers no little concern. The scope of Selden's claims, and the fact that he seemed to be a pioneer in his particular field of activity—indeed, the Commissioner of Patents has even stated such to be the case—induced the Columbia and Electric Vehicle Company to purchase the patent. For that reason the company has begun an infringement suit against two of its rivals, the outcome of which is awaited more or less anxiously by many, if not all, manufacturers of petroleum vehicles.

Whether the Selden patent be valid or not, is a question which can be definitely answered only by the courts. Certain it is, that if the charge of infringement be sustained, the shops of many an automobile maker will be closed.

It is not the particular type of engine used by Selden upon which the suit is based; indeed, if the truth must be told, the engine would now be considered antiquated. Although a particular type of motor was described, Selden did not limit himself to that type. As he himself stated, any liquid hydrocarbon motor of the compression type might be used. He did, however, claim to have been the first to employ in combination with a carriage driven by a hydrocarbon motor a clutch mechanism interposed between the driving shaft and the propelling wheels, by means of which mechanism it was possible to throw the motor and the driving-axle in and out of gear. Selden saw the inconvenience of extinguishing the ignition flame in order to bring the carriage to a standstill. The necessity of starting up the motor by hand rendered the provision of a device, whereby the carriage could be stopped, although the motor were still in operation, of no little importance. He, therefore, introduced the clutch which, it may be safely said, constitutes the cardinal element of his invention. The arrangement is covered in the first and broadest of his claims, which reads:

"The combination with a road-locomotive, provided with suitable running-gear including a propelling-wheel and steering mechanism, of a liquid hydrocarbon gas-engine of the compression type, comprising one or more power cylinders, a suitable liquid-fuel receptacle, a power-shaft connected with and arranged to run faster than the propelling-wheel, an intermediate clutch or disconnecting device and a suitable carriage-body adapted to the conveyance of persons or goods."

It has been stated that a shaft arranged to run faster than the propelling wheels and an intermediate clutch or disconnecting device was never known before the date upon which Selden filed his application. The suit will be watched with much interest by the profession, as there is a good deal of difference of opinion as to the general line of defense that will be taken up by this defendant.

RAIL-JOINTS AND STREET NOISES.

Speaking of the contribution of railroad traffic to the sum total of city noises, reminds us that the present form of rail-joint contributes a large share to the general din of street and railway travel. In spite of the many excellent forms of rail joints that have been brought out in the past ten years, such a thing as a noiseless joint has yet to be produced. Evidence of this fact can be found in listening to the "anvil chorus" which marks the progress of a train on the Manhattan Elevated Railway, where the blow which is given by every wheel as it passes the joints may be heard many blocks away; and yet the Manhattan Railway has been fitted exclusively with a joint which is acknowledged to be one of the very best on the market! In the case of the Manhattan Company, it is only fair to say, the noise is greatly intensified by the metallic structure of the viaduct, which acts like a huge sounding board.

The concussion which is produced whenever a wheel passes a joint is due to the fact that as a wheel leaves the end of a rail, that rail end is depressed below the end of the rail against which it abuts, and consequently the wheel, in passing to the rail ahead, strikes it a blow which has considerable longitudinal effect in it. Hence, the loud clangor which accompanies the passage of the train over a stretch of track with "loose" or "low" joints, a clangor which increases in direct ratio to the poor quality of the track.

If ever the inventor shall succeed in producing a joint that is literally "as strong and stiff" as the body of the rail itself, this trouble will vanish and we shall have a practically silent track. Some of the best joints upon the market come, theoretically, up to this mark; but when they are placed in the track, and are subjected to the hammering action of the enormously concentrated loads which characterize the modern engine and train, it is not long before the well-known click begins to be noticeable, giving warning that the failure of the joints has commenced, and that a deterioration has set in which no amount of subsequent care on the part of the section gang can prevent. During the past few years we have watched with great curiosity the behavior of the joints on certain sections of the underground trolley lines in this city and on certain trunk railroads which have their terminus here. The rails in each case weigh from 100 to 107 pounds to the yard, and the joints are well spliced and heavy; yet it has never been more than six to nine months before the hammer-like blow of the wheels, as they passed the joints, began to be audible, and each year's traffic has shown a slow but certain deterioration in their resisting power. Theoretically, the perfect remedy is to be found in abolishing joints altogether and welding the rail ends. Could this be done, and carefully done, when the rails are first put in, we see no reason why the difficulty should not be solved altogether, and for good. And we suggest that while the Metropolitan Railroads are making the vast improvement of putting in the third-rail and abolishing the locomotive, they should also try the welded joint on a mile or two of their track, to see whether they cannot at least modify, if not altogether abolish, the loud hammering which marks the passage of their trains.

RESOURCES AND IMPROVEMENTS IN CHINA.

China is essentially an agricultural country. Horticulture is a favorite pursuit and fruit trees are grown in great variety. Sweet barley, maize and millet and other cereals, with peas and beans, are chiefly cultivated in the north, and rice in the south. Sugar, indigo and cotton are cultivated in the southern provinces, and opium is a crop of considerable importance. Tea is cultivated in the west and south. The culture of silk is equal in importance to that of tea. The mulberry tree grows everywhere. There are cotton mills at Shanghai and silk is wound from cocoons in Shanghai, Canton and elsewhere. All of the eighteen provinces contain coal and China may be regarded as one of the first coal countries in the world. Iron ores are abundant and copper is plentiful in certain districts. The commercial intercourse of China is quite considerable, trade being carried on with the principal countries of the world, includiug the United Kingdom, Germany, France, Russia and the United States. The great source of revenue for the provinces is the duty on goods coming overland from the adjacent provinces.

Until February, 1898, no foreigner could travel in the Empire except at certain designated points, usually the treaty ports, but since that time all foreigners who have passports, may visit any part of the Empire on pleasure or business. The roads in China are poor and only a few are paved, and for this reason the greater part of trade is carried on by means of numerous canals and other waterways. The country is irrigated by great rivers, and intersected by a system of canals which is more than six hundred years old. The canals are badly managed and are in a state of decay.

Less than five hundred miles of railway have been constructed in China, but a very complicated system has been projected, and Government concessions have been given for the purpose. It is likely that as soon as the present trouble in China is adjusted, that this country will be the scene of great activity in railway building. In all, concessions have been given for 7,500 miles of railway. This will include connections with the Chinese Eastern Railway, the railways to Shanghai, Hankow, Canton, and Mandalay. As the country is 3,500 miles long from north to south, possessing a varied climate, productive soil, and great natural resources, it will be seen that there is a vast field for enterprise in railway building, and European countries and the United States are only desirous of seeing a stable and friendly government established before they begin to invest their capital in vast railway enterprises which cannot but prove to be profitable investments.

All the principal cities of the Empire have telegraph service. An arrangement was made with the Russian telegraph authorities in 1892 by which communication was established between Peking and Europe. The apparatus and methods used in telegraphing in China are of the most primitive description. The Chinese have no alphabet, but each word has a sign. In order to telegraph them, each sign has to be numbered, and the number is sent by wire. The receiving clerk refers

to his tables and translates the number into the Chinese signs. The tables resemble logarithm tables, the signs being printed in vertical columns and each column containing 20 signs, and as there are 10 columns, there are 200 signs to the page. There are 49 pages to the complete book, consequently there are 9,800 numbered signs. Each square contains a sign for a word. The sender must write his message in Chinese on a blank form; this is then converted into numbers, and they are telegraphed.

The average length of the words is four letters, but the words frequently run to ten or twelve letters.

The postal system of the Empire is still in a primitive condition. It is carried on under the direction of the Minister of War, by means of post carts and runners. There are 8,000 offices for post carts in the eighteen provinces, and there are 2,040 offices for runners scattered over the Empire. There are also many private postal couriers, and during the winter the foreign customs office maintains a service between Peking and the outposts.

THE NEW AGRICULTURE OF THE TROPICS.

The agriculture of the tropics differs widely from that of the temperate zone, but the same general principles of culture, improvement of plants by careful selection, and systematic conversation of the fertility of the soil, apply to both. In the tropics nature is supposed to do most of the work, while the farmers merely plant and harvest. The natives of most hot countries are content to accept this version of farming, and hence live a life of idleness with little thought for the morrow. In spite of their neglect of the trees, vines and plants that yield fruit, they rarely suffer from famine or lack of food, unless their crops be destroyed by hurricanes or floods.

But while tropical agriculture is easily compared with farming in more northern countries, it has never been completely successful without the systematic application of scientific principles. Part of the "white man's burden" has been in the tropics to revolutionize agriculture. Without proper agricultural implements, lacking the means and knowledge to develop the soil and plants, the natives have made no improvement on their antiquated methods.

The possibilities of tropical agriculture are only faintly understood to-day; but an idea of what the future may hold in store for scientific farmers can be gathered from the advances already made by the English, Dutch, German, and Americans in the tropical lands which they have occupied. Before white men settled in tropical America the sugar industry was in the most primitive condition. Machinery for extracting the juice of the cane was unknown, and the plants were semi-wild growths that yielded a very small percentage of sugar. English, American, and German settlers immediately proceeded to develop a higher type of sugar cane, and to invent machinery that would simplify the work of obtaining the sugar. The improvement of the sugar-cane plants and the invention of adequate machinery have added hundreds of millions of dollars of wealth to tropical America, and have given regular employment to the natives.

Rice and cotton are two other typical plants of the tropics which have come under the control of the white farmers. In our own Southern States these crops have been so improved within the memory of the present generation that the yield of every acre has been tripled and the quality of the products improved fifty per cent. The culture of both rice and cotton in the United States by Americans and in Egypt by Englishmen is systematic and intensive. Machinery supplements farm labor, and adds millions of dollars to the value of the crops. The improved cotton plants of to-day represent almost distinct types from those cultivated by the natives in other lands.

The coffee plant originally cultivated by the aborigines of the tropics were inferior producers of a bean so poor in quality that it would now hardly be tolerated in any household. The bean was small and without flavor, and the scraggy plants yielded small, uncertain crops. The Dutch farmers cultivated and improved the plants in Java until a standard was reached which has not yet been surpassed. Brazil abounded in coffee plants, which the natives indifferently cultivated until white men came and showed them how to make their plants grow coffee better in quality and larger in quantity. Brazilian coffee is likely to meet a formidable rival in Porto Rican coffee in the near future if American farmers apply the same care to the development of the crop that they have bestowed upon other tropical plants that have fallen into their hands.

When California and Florida came into our possession we had no territory that was even semi-tropical in climate or products; nevertheless, these two States gave the American farmer an opportunity of showing his skill in tropical horticulture. The wonderful orange groves of the two States, with their abundant crops of the finest fruits in the world, the extensive orchards of olives, figs and nuts, the great vineyards, the ranches and plantations of bananas, lemons, grape fruit, and scores of tropical and semi-tropical fruits, testify to the skill and success of Yankee farming in tropical or semi-tropical zones.

Fruit-culture in the tropics is at present in the most primitive stage; except in a few notable instances, these tropical products are grown just as nature first produced them. Little or no attempt has been made to double the yield or to improve the quality. The policy of the native farmers has been to do no more than was actually necessary. In view of the changes in the tropical geography of the world wrought by recent wars, the question of the future of the agriculture and horticulture of these lands is rapidly assuming great importance. If the possibilities of the soil and climate under improved culture and the application of farming implements and machinery are all that leading scientists claim, the world's food supply ought to be doubled and tripled in the next decade or two.

According to scientific horticulturists, these improvements will be along two lines. The first will be the improvement and development of the soil so that its utmost capacity can be measured. As in the north, the earth will be fed and not simply robbed of its fertility. An acre of pineapples, bananas, or cocoanuts under a good system of culture should produce twice as many fruits as it does to-day. Modern machinery and farm implements will help the crops in thus utilizing the fertility that has been buried in the subsoil for thousands of years. The loosening of the top soil, and the consequent freeing of the imprisoned nitrogen, should stimulate the growth of the trees and plants so that they will assume a greater size and productivity.

But while intensive methods of agriculture and horticulture in the direct line of cultivating the soil will have marvelous effects, the greatest improvements are looked for in the improvement of the plants and products by careful selection, hybridization, and grafting. Our horticulture owes much to these simple processes. The white men have brought from the tropics plants which have been adapted to cold climates. If the same methods are employed to improve the tropical plants in their own homes the results must be even greater. This has already been demonstrated in the banana, cocoanut, pineapple, and orange groves of South and Central America. The new plantations of cocoanut trees in Central America are not only producing larger crops than the old ones, but the nuts are far superior in size and quality. An American syndicate operating fruit farms in Central America has already shipped an improved variety of pineapple north that almost equals the famous London hothouse pineapples. The bananas are so susceptible to improvement that horticulturists do not hesitate to predict that they will soon be produced twice the size of those now imported. But quality as well as size is considered. The development of the "lady finger" bananas is now in course of rapid progress, and this delicate fruit will have a flavor in the future that will be beyond compare.

We are just on the threshold of developing the world's crop of fruits. In the temperate zones the grains, cereals, and cattle have reached a higher stage of evolution than any other products; but the day for the fruits of the tropics is dawning. From South and Central America, from the islands of the Pacific and Atlantic, from equitorial Africa, and from the lands of the Orient, streams of tropical fruits will in the near future pour into Europe and America in return for the cereals, meats, and products of the colder climes. Under modern agricultural methods, an abundance of fruits for the whole world can be raised in these warm regions at a cost so low that none need be so poor as to go without them. The importance of this change of food supply upon our national diet will be of interest to those engaged in the physiological study of the civilized man. With rich nourishing tropical fruits so cheap, our meat diet among the poor, at least, must decline. The effect upon the physical and mental characteristics of the race will be interesting. One of the chief drawbacks to the more rapid spread of vegetarianism is said to be due to the insufficient variety of our common fruits and vegetables. The cultivation and development of the fruit crops of the tropics by white settlers must inevitably tend to remove this restriction.

In the tropics the people are largely vegetarians. It would not be so difficult to spread and popularize the principles of vegetarianism in a land where one's meal might well consist of a dozen different varieties of luscious and nourishing fruits, nuts, and vegetables.

G. E. W.

INDICAN.

Indican may be obtained from indigo leaves in colorless, spear-shaped crystals by treating an aqueous decoction with barium hydroxide, filtering off impurities, and removing excess of the base with carbon dioxide; the filtrate is evaporated to dryness, and the crude residue extracted with methyl alcohol, adding ether to the extract to precipitate the last traces of foreign substances. The solvents are then distilled off, and the final residue dissolved in water, the solution being allowed to deposit the glucoside. It crystallizes with $3H_2O$, melts at 51° C., and passes into a gummy mass at 100° C. When dried in a vacuum over sulphuric acid, indican loses its water of crystallization, and then melts at 100° to 102° C. Analysis seems to indicate the formula $C_{14}H_{17}NO_6$. The glucoside is moderately soluble in water, acetone or the alcohols, and has a bitter taste. When air is passed through a solution of indican in dilute hydrochloric acid containing a little ferric chloride, 91 per cent of the glucoside is converted into indigotin, a certain amount of indigo red being simultaneously produced.

AS OTHERS SEE US.

The vagaries of American journalism is a favorite theme with the Transatlantic editor, especially at such times as for want of a fresher topic he must fall back upon his list of stock subjects for an inspiration. It is possible that now and then we, on this side of the water, do allow imagination to trespass upon the domain of fact; but never, surely, have we eclipsed the performance of our contemporary. In a representation of the scene of the Hoboken fire, published in one of the leading English illustrated weeklies, the Hudson River is shown to be spanned by two colossal bridges, one at Twenty-third and the other at Fifty-ninth Streets. Where the imagination of the artist received its stimulus we cannot tell—though we might hazard a guess—but certainly this view was not drawn "upon the spot," or even "from a photograph."

The two structures referred to exist only upon paper. That at Twenty-third Street was designed some dozen years ago, by Gustav Lilienthal; the Fifty-ninth Street bridge bears a slight resemblance to the design drawn up by an army board of engineers for a 3,000-foot cantilever, with a view to estimating its cost in comparison with the cost of a 3,000-foot suspension bridge. Badly as these two bridges are needed, the cost is prohibitive; for not even the most sanguine promotor dares to assert that their revenues would cover the interest on the initial outlay of from $110,000,000 to $140,000,000 for bridges, real estate and terminals.

THE PRESERVATION OF WILD ANIMALS OF AFRICA.

A convention was signed at London, on May 19, 1900, for the preservation of wild animals, birds and fish in Africa. The contracting parties are the Queen of England, the Emperor of Germany, the King of Spain, the King of the Belgians, the President of France, the King of Italy, and the King of Portugal. The zone within which the provisions of the convention apply is bounded on the north by the twentieth parallel of north latitude; on the west by the Atlantic Ocean, and on the east by the Red Sea and by the Indian Ocean, on the south by the line following the southern boundary of the German possessions in Southwestern Africa. The contracting powers declare that the most effective means of preserving the various forms of animal life existing in a wild state within the zone is the prohibition of hunting and destruction of vultures, secretary birds, owls, rhinoceros, giraffes, gorillas, chimpanzees, mountain zebras, wild asses, white-tailed gnus, elands, and the little Liberian hippopotamus.

The convention also prohibits the hunting and destruction of the young of elephants, rhinoceri, hippopotami, zebras, antelopes and gazelles, ibexes and chevrotains. The killing of the same species when accompanied by their young is also prohibited. Limited numbers of some of the animals may be killed, and lions, leopards, hyenas, hunting dogs, otters, baboons and other harmful monkeys, large birds of prey, owls, crocodiles, poisonous snakes and pythons may be killed. It is prohibited to hunt the wild animals within the zone except by persons who are holders of licenses issued by the local government, which are revocable in case the provisions of the convention are not carried out. Nets and pitfalls for taking animals are not allowed, and dynamite and other explosives must not be used for taking fish. Particular attention is given to hunting and killing young elephants, and all elephant tusks weighing less than twelve pounds are to be confiscated, provided that the animal was not killed before the convention goes into effect. The eggs of ostriches are also protected, but the eggs of the crocodile, poisonous snakes and pythons are to be destroyed. The contracting parties undertake to apply as far as possible, each in their respective positions, measures for encouraging the domestication of zebras, elephants, ostriches, etc. The convention was duly signed in London, and after having been ratified by the powers shall remain in force for fifteen years.

The preservation of animals in Africa will interest all who care for natural history, or for the animals which inhabit the immense forests and deserts of this great continent. Rapacious gatherers of hides or ivory bid fair to exterminate certain classes, and they are assisted in their endeavors by hunters who often shoot innocent, valuable animals in large quantities for mere sport. With proper care Africa can become a great game preserve for the world, where hunters may go and enjoy their pursuit with reasonable chances of success, but the wholesale destruction of animals by either sportsmen or professional hunters is to be deplored.

THE QUEEN-SCHULTZ CHRONOSCOPE.

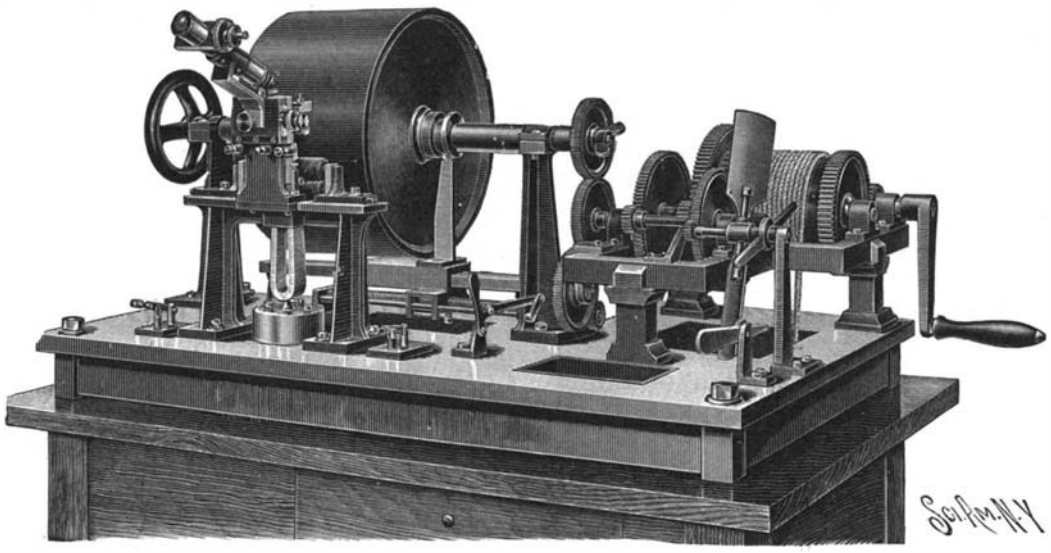
The Queen-Schultz Chronoscope made by the well-known firm of Messrs. Queen and Company, 1010 Chestnut Street, Philadelphia, Penn., is a modification of the chronoscope invented by Captain Schultz of France for the purpose of measuring exceedingly small intervals of time, and especially for measuring the velocity of projectiles while traveling along the barrel of a gun.

A drum, one meter in circumference, covered with a coating of lamp black is driven by means of a clock-train and weight so as to revolve once per second and at the same time slowly advance longitudinally. In front of the drum, mounted on a support and actuated by two magnets, is a standard tuning-fork, vibrating 250 times a second; on one limb of this fork is a quill which traces a line on the blackened surface of the drum and therefore will record 250 complete vibrations for every revolution of the drum.

A telescope with micrometer is also attached to the tuning-fork and each vibration of fork, traced on the drum in form of a curve, can be subdivided into 1,000 parts, thus allowing readings to be made to $\frac{1}{250000}$ of 1 second. On the support with the tuning-fork is a small pointer which traces a straight line on the drum. This pointer has an electrical connection with an accurate chronometer, which at every ½ second closes the circuit and causes the pointer to make a succession of records on the revolving drum, these marks serving as starting points to count the number of vibrations of the tuning-fork, and to check them up every ½ second.

In order to measure the velocity of projectiles the gun must be fitted along its bore with special electrical circuit-breakers usually placed 1 foot apart. Each circuit-breaker is so constructed that the current is interrupted as the projectile passes, but is made again before the projectile reaches the next breaker (1 foot further on).

These breakers, with a suitable battery, are all in one circuit with the primary of an induction coil. One terminal of the secondary of the coil is grounded to the frame of the chronoscope, while the other terminal consists of a fine point near the blackened surface of the drum. Therefore, when the primary circuit is opened by the first circuit-breaker along the bore of the gun, the spark induced in the secondary of the induction-coil jumps from the points to the revolving drum, leaving a distinct mark on the blackened surface. As the next circuit-breaker in the gun is passed, the spark again passes to the drum; and this operation is repeated for every breaker along the gun-bore. Thus on the drum, alongside of the inductions made by the tuning-fork, will be recorded a succession of spots at certain distances from each other. The time elapsing between any two of these spots can be calculated directly from the record which the tuning-fork made, and thus the time (measured to the 1/250,000 part of a second) taken by projectile in passing a known distance along the gun-barrel calculated.



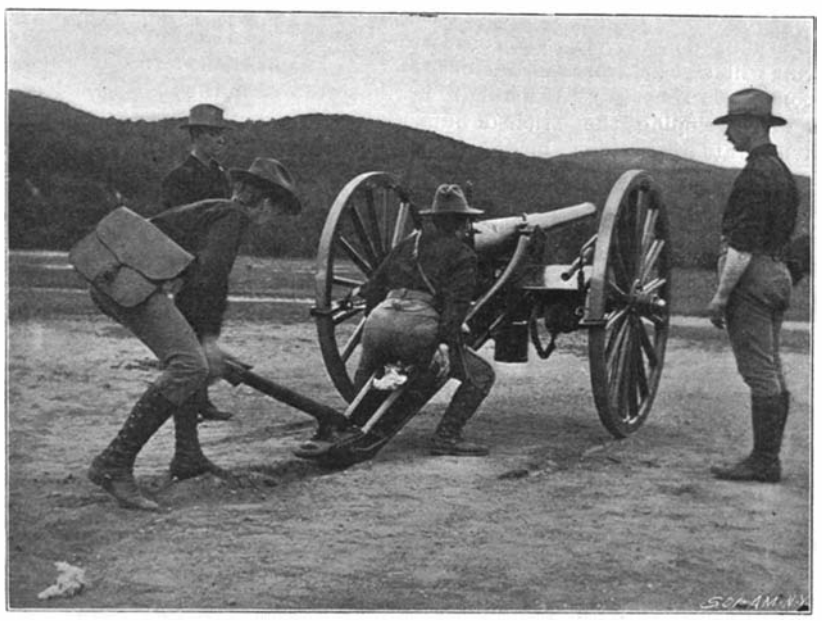
THE QUEEN-SCHULTZ CHRONOSCOPE.

ARTILLERY PRACTICE OF THE NATIONAL GUARD.

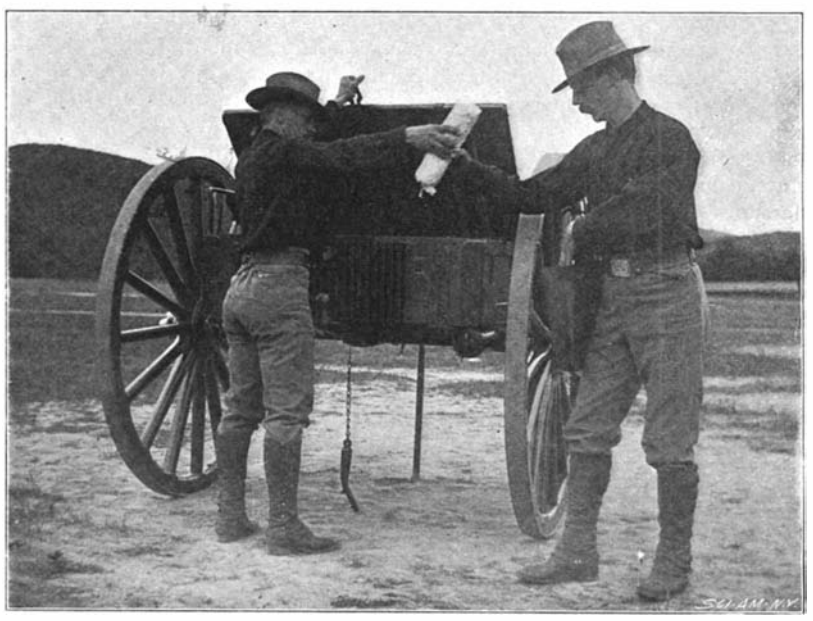
For want of a suitable range it is only within a comparatively recent period that the different batteries comprising the artillery branch of the National Guard of New York State have had an opportunity to perfect themselves in accurate shooting. While the infantry were provided with every possible convenience, such as a rifle range in each armory, and the magnificent grounds at Creedmoor, the artillery were apparently sadly neglected. But this is now changed, and, considering the small amount of practice, the result of the recent contest at the State artillery range at Camp Townsend was most gratifying. In 1896 an impetus was given to good shooting by the presentation of the "Flanagan Trophy," and it has since been won by each of the three batteries composing the contestants. The "Trophy," as it is familiarly called, is a bronze figure of Napoleon, and, with its pedestal, is about six and a half feet in height. It was donated by Captain Flanagan, of the Second Battery, and the conditions were that it was to be shot for once each year by the First, Second and Sixth Batteries. The battery winning holds the "Trophy" for the term of one year, or until the next contest, and the battery that is three times a winner takes final possession of it. In 1[illegible] it was won by the First Battery, Major Wendel; in 1897 the Sixth Battery, Major Olmstead, took possession of it, while it has now been in the armory of the Second Battery, Major Wilson, for two years, they having won it in 1899 and 1900. No contest took place in 1898, the Spanish war claiming all our attention. The target has, heretofore, been placed at 1,000 yards, but in the last contest the gunners had a chance to test their accuracy to a nicety.

Col. N. B. Thurston, inspector of ordnance on Gen. Roe's staff, was determined to bring out the fine points of artillery shooting, and, therefore, provided a range of 3,100 yards, almost 2 miles. When it is remembered that these men had never before sighted their pieces and fired at anything beyond 1,000 yards, slightly over a half mile, the accuracy displayed was remarkable. Sighting a gun at a black speck on a white patch in the distance and then planting a shell within a few feet of that black speck is no easy matter, and yet it was done repeatedly, one shot demolishing the target, so that it had to be repaired, causing a long wait. The target being so remote, the services of the Signal Corps were called into play, and after each shot a large amount of wigwagging told the result. The guns used are the standard United States 3·2-inch breech-loading rifle, the same gun that is furnished to all the regular light artillery. In the contest each battery uses two guns, and twenty shots are fired in all, ten from each gun. Ten shell and ten shrapnel are used, the shell target having a bull's-eye, while the shrapnel is fired at an unbroken white mark. Target No. 1 is 20 × 12 feet, and No. 2 (shrapnel) measures 40 × 12 feet.

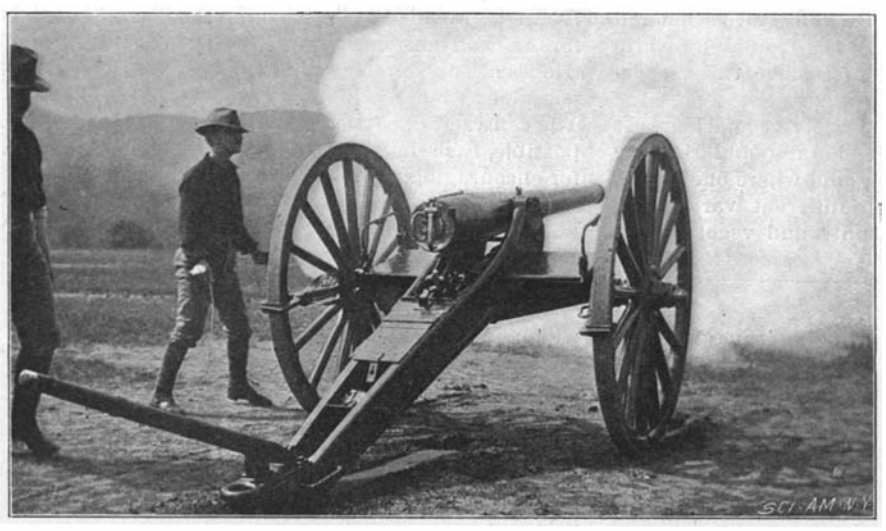
In the first instance, a hit consists of the shell going



Sighting a Gun.



Getting a Fresh Charge of Powder.

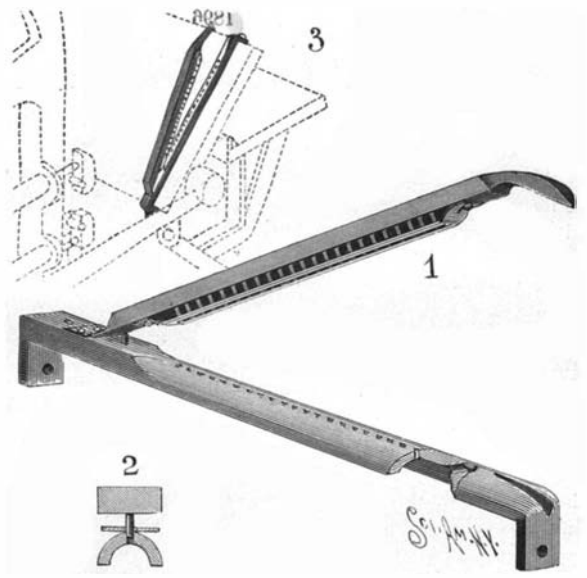


Gun No. 1, First Battery; Getting the Range.

Second Battery Relaying Gun After Recoil.

ARTILLERY PRACTICE OF THE NATIONAL GUARD.

through the target and exploding on the other side, but the shrapnel is totally different. In the war head of this dangerous projectile are several rings of blind holes, reminding one of woodpecker's holes in a dead tree. Each one of these holes means ¼ second on the fuse that runs around the inside, and just before inserting in the gun, a tool resembling an awl is driven through one of these holes, puncturing the fuse at the desired point. It is aimed to explode the shell a short distance before reaching the mark, the explosion throwing the numerous bullets and fragments over a large area, spreading out in shape similar to a cone. The



PERFORATOR FOR PRINTING PRESSES.

time from the gun to the mark on this range was 7 seconds, and, when one's nerves are on a tension, waiting for the shell to explode, 7 seconds seems a very long period. As before stated, the winner on this range was the Second Battery, making 197 points, the Sixth gaining 185, and the First 41. The First Battery fired on June 15, the Second Battery on June 19, and the Sixth Battery on June 20. If the Second wins the "Trophy" next year it will close the contest, as they will then have been a winner three times.

We are indebted to Mr. G. E. Stonebridge, the author of the article, for the accompanying photographs.

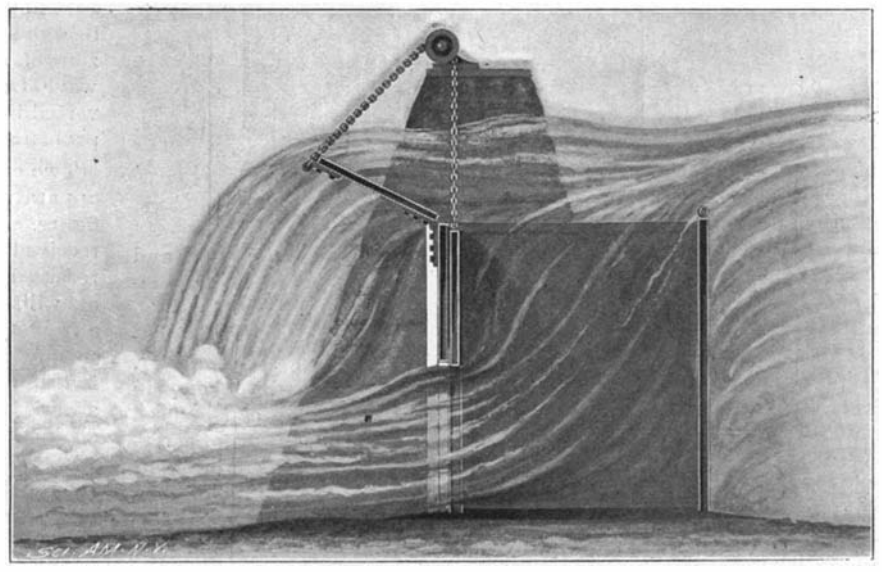
THE HONE AUTOMATIC FLOOD-GATE.

When it is considered how many disasters are caused by the sudden overflowing of reservoirs and dams, it is not astonishing that inventors should have endeavored to devise some mechanical means which would automatically allow the surplus water to escape as soon as the level would rise above a certain height. The most recent contrivance of this nature is the invention of Mr. Henry Hone, of Chicago, Ill., who conceived his idea while in charge of one of the mountain-lakes of Colorado. Mr. Hone's apparatus presents many novel features of construction, among which may be mentioned the means provided for discharging the water near the bottom, without draining the dam.

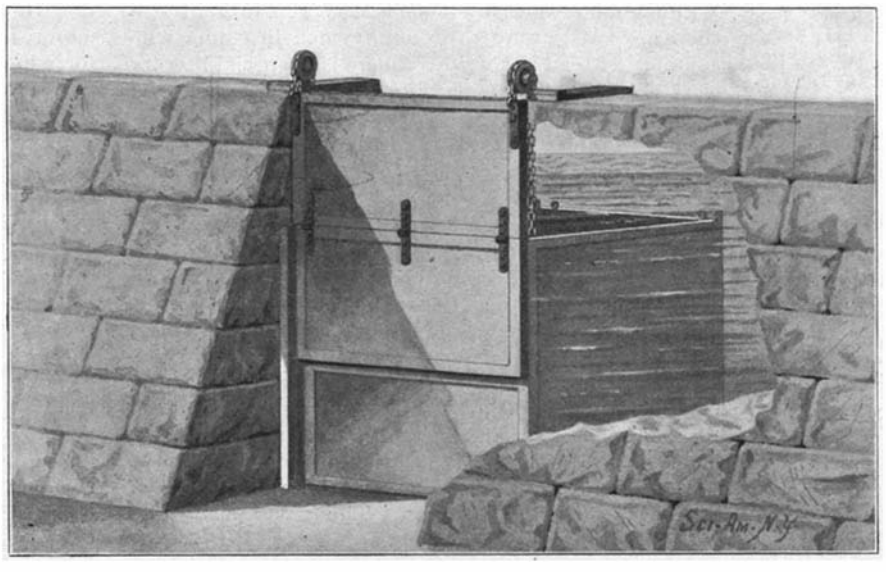
In the dam-wall a casing is set, which is permanently closed at about its middle portion, leaving an open port below and a space above, which is normally closed by a door hinged to the partition. Secured to the hinged door are chains passing over idlers and secured to a valve sliding vertically in guides so as to close or open the port below the fixed partition. Together with the partition and the hinged door, the valve completely closes the breach of the dam in which the casing is set.

The hinged door is arranged above the normal level of the dam and is, therefore, closed ordinarily. When, however, the water rises above a certain height, the pressure forces the door down, causing the valve to be raised and the lower port to be opened, and allowing the surplus water rapidly to escape. As the level of the water falls, the door swings back, thus causing the valve to close the port. To prevent the door from being thrown so far forward that a return is impossible, a stop is provided which limits the upward movement of the valve.

It may happen that driftwood or other obstructions may not permit a return of the door, thus preventing the valve from closing the port, and allowing the dam to drain. The inventor, therefore, employs a box having an open top, but standing around the port so that all water must pass over the box. Evidently the dam can never drain below the top wall of the box. Back pressure of the water is also prevented from hindering the gate in its action. In the rear of the tank a door is provided which can be easily drawn up to permit complete drainage whenever desired. To increase the stability of the gate as an integral part of the dam, a broad flange extends from the sides of the gate into the dam, and from the bottom of the gate into the foundation upon which the gate rests, to prevent any leakage. More extended information can be obtained from Mr. W. I. Reedy, of 91 Illinois Street, Chicago, Ill.



GATE OPEN, SHOWING FLOW OF WATER.



GATE CLOSED, SHOWING RETAINING BOX.

A PERFORATOR FOR PRINTING PRESSES.

In printing bank-checks and similar stationery the operations of printing and perforating have hitherto been performed separately, thereby consuming no little time and requiring considerable labor. A perforator has been invented by Mr. Gustavus A. Evans, of Nelson, British Columbia, by means of which the checks can be printed and perforated at one operation. Fig. 1 shows the device in perspective and Fig. 2 in cross-section. Fig. 3 is a reduced view of the perforator as applied to a press.

The device consists of two parts, a bed-piece and a punch-bar. The bed-piece is provided at its ends with lugs which are screwed to the top and bottom edges of the platen in the manner shown in Fig. 3. A series of holes in the top of the bed-piece open at their inner ends into a channel formed on the under side of the bed-piece (Fig. 2), which channel serves to receive the disks cut out of the paper, openings being provided which lead from the ends of the channel to the face of the bed-piece so that the disks can be discharged.

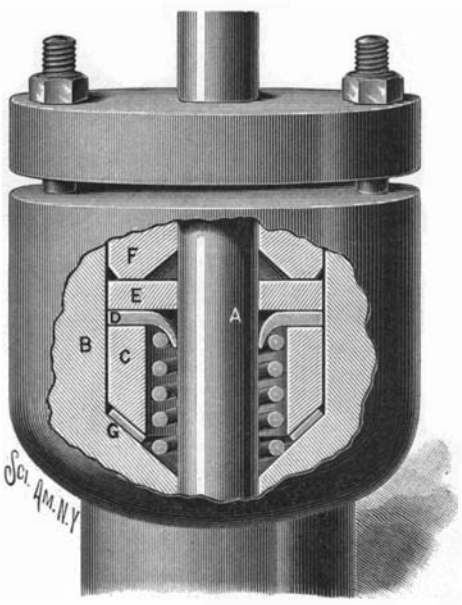
At its ends the punch-bar is provided with springs, the lower of which is screwed to the bed-piece, and the upper of which is formed with a V-shaped guide which is designed to engage a correspondingly-shaped recess in the bed-piece to insure correct perforations (Fig. 1). The lower spring normally holds the punch-bar in open position. On the under side of the punch-bar are punches designed to register with the apertures in the bed-piece when the impression is made. To release the paper a slotted bar, spring-secured at its ends and longitudinally movable, is mounted beneath the punch-bar.

When the punch-bar moves into a closed position, then the paper-releaser moves in contact with the bed-piece, and is flattened out. As the paper extends over the face of the bed-piece, the releaser engages the paper at the closing of the plates and securely holds the paper in place during the perforation. When the platen opens, the punch-bar is also opened by the lower spring previously mentioned, thus withdrawing the punches from the paper. The releaser then returns to its normal position, and in so doing cleans the punches.

The perforating device can be readily attached to the end of the platen, so that the face of the tympan can be brought almost level with the top face of the bed-piece, rendering it possible to print close to the perforations, if need be, without tearing the paper.

AN IMPROVED PACKING.

We present herewith an illustration of a novel packing invented by Wilbert Black, of 3917 Annunciation



A NEW PACKING.

Street, New Orleans, La., which packing can be readily applied to the stuffing-boxes of hydraulic and other plunger pumps in order to prevent the passage of fluid in both directions.

The packing is here shown applied to a pump, the barrel of which has a box, *B*, to which a gland, *F*, is fitted. In the barrel a plunger, *A*, reciprocates. The box, *B*, contains a snugly-fitting thimble, *C*, which receives the plunger as well as an expansive spiral spring bearing on the bottom of the box, *B*. A leather washer, *G*, is interposed between the lower end of the thimble and the bottom of the box. The upper end of the thimble forms a seat for a leather packing-crimp, *D*, turned down and engaged by the upper end of the coiled spring. Upon the crimp, *D*, a ring, *E*, is set, which ring is held down by the gland, *F*, between the thimble, *C*, and ring, *E*; and the inner portion of the crimp is left free to accommodate itself to the movements of the plunger. On the compressing stroke of the plunger, the crimp, *D*, is forced outward against the plunger principally by the pressure developed within the barrel. On the return stroke of the plunger, the crimp, *D*, is forced by the spring against the plunger to prevent the entrance of air into the barrel during the outward movement of the piston, the air being partially exhausted within the barrel during the outward stroke.

The Protection of Dynamite Magazines.

Trials have been made in France relative to the best method of building dynamite magazines. One was constructed to hold 1,100 pounds of dynamite. A gallery of communication 55 inches in height and width was bent twice like a hand brace and at the outlet ended in the safety automatic plugging device. This consisted, says The Engineering and Mining Journal, of a prolongation of the gallery through a mass of cement poured into an excavation made around it. In front of this channel the plug, which is of cylindrical shape, 48 inches in height and width, is placed. Two-thirds of its length is made of cardboard, or rather, leather board, and the remainder of wood. The contents were fired by electricity; a dull report was heard and after a few minutes smoke was observed to be issuing from the orifice, and the experiment was declared to be successful.

A SUCCESSFUL operation has just been performed in St. Luke's Hospital, New York City. A tumor was removed from the inside of the sheath of the spinal cord. It was necessary to cut into six vertebræ, and the patient was kept under anesthetics for more than three hours. He was operated upon after a number of German specialists had pronounced that his ailment was rheumatism.

Automobile News.

An automobile recently made the trip from Boston to Newport in two hundred and forty-seven minutes. The return was made by another route in less than three hours. The distance was 75 miles.

Automobile affairs are making progress in Spain, and a new automobile club is to be organized at Barcelona; for this purpose a preparatory committee has already assembled and a general meeting will shortly follow. A new automobile transportation company has recently been formed in Spain, under the name of Sociedad Automovil de Burgo de Osma, which intends to establish a service of automobile vehicles for transporting passengers and freight between Logrono, Soria, and Osma.

The International Congress of Automobilism opened on the 9th of July in the Palais des Congrès, at the Exposition; the remaining sessions were held at the Automobile Club of France, in the Place de la Concorde. The programme before the Congress is divided into five sections: 1. Steam motors, explosion motors, and divers types. 2. Electric motors. 3. Transmission systems, frames and their organs, carriage building. 4. Traction force. 5. Economic questions, international and historic questions.

An automobile congress has been recently held at Padua, at which was decided the itinerary of the race called the "Tour of Italy," which is being organized on the same lines as the long touring race held in England. It will be held in April, 1901, and the distance covered will be 3,100 miles. A road race has been recently held at Padua, over a distance of 130 miles, with the following results: Tricycles: 1, Gasté, 4 h. 52 m. Quadricycles: 1, Bugatte, in 4 h. 44 m. Voiturrettes: 1, Padovani, in 8 h. 13 m. Carriages under 880 pounds: 1, Frat, in 4 h. 39 m. Carriages above 880 pounds: 1, Colteletti, in 4 h. 52 min. The road race of 30 miles for motocycles was won by Masseratti in 1 h. 23 m.

An important series of experiments with automobiles for use in the French army will take place in September at the great autumn maneuvers, near Chartres. At the maneuvers of last year experiments were made in this direction under the supervision of M. Journu, a well-known automobilist; as a result, Major Richard was appointed to select a type of automobile suitable for traction, but as the machine chosen was not satisfactory upon trial, the authorities decided to renew the experiment this year on a more extensive scale, with the assistance of private enterprise. For the military transport, eight machines will be used; of these, four have petroleum motors and four use steam. As in previous years, the service of the general staff will be performed by automobiles steered by the leading amateur conductors. General Jamont will use the machine of M. Brisson, of 12 horse power, and General Delanne that of M. Herault, of the same power; Girardot and Antony will conduct two of the other generals, each with a 24-horse power machine. M. Journu will have general supervision of the tests.

The official report relating to the tests of automobiles made at the Yorkshire Cycle and Motor Show, gives a number of interesting figures. Among the machines tested may be mentioned the steam automobile of J. Coulthard & Company, of Preston. It is a quadricycle, transporting a load of 2 tons, placed on a platform in the rear. The total length is about 14 feet, and width 6 feet; the wheels, in wrought iron, have 2·6 feet diameter in front and 2·7 feet in the rear, the tires being 4 and 5 inches wide respectively. The boiler is of the vertical type, tubular, having 9 square yards of heating surface and heated by petroleum; the safety valve is regulated at 30·8 pounds. The water reservoir has a capacity of 58 gallons and that of petroleum 23 gallons. The vertical engine is triple expansion, with three cylinders, the diameters being 2·8 inches, 4·6 and 6·1 inches, with a stroke of 5·1 inches. The motor is well balanced and of good construction; it makes normally 500 revolutions per minute. The boiler is fed by a pump or an injector at will; the escapement passes into a condenser of the Royle type, and the water of condensation is collected in a reservoir. The transmission from the main shaft to the axles is effected by toothed wheels and Renold chains. The total weight of the vehicle is 5,720 pounds complete. It is provided with three speeds having the ratio of 1,2 and 3.

The series of tests of motocycles recently made at Vincennes Park is of interest as showing the performance in general and the consumption of petroleum of the latest types. The tests were carried out with care under a competent jury, and the points observed were, first, the regularity of running, necessity of repairs, etc.; second, consumption of gasoline; the speed was not taken into account. Twelve motocycles entered the competition; five were tricycles, three quadricycles, and four bicycles operated by petroleum motor, this being mounted either in front or underneath the saddle. The latter did not give a remarkable showing, as only one was able to finish; but, however, with good results. In each of the classes, first and second prizes were given, consisting of gold or silver medals. The following figures are given for the machine taking first prize in each class, and will thus show the performance of the most improved types. 1. Tricycles, constructor, Rochet; motor, De Don, vertical type, 3 inch bore and stroke, 1,800 to 2,000 revolutions per minute; weight of motocycle, 266 pounds; consumption of gasoline, 5·8 gallons; distance, in each case, 480 miles; mean speed, 23·1 miles per hour. 2. Quadricycles, constructor, Rochet; motor, Aster vertical type, 3-inch bore and 3¼-inch stroke; weight of quadricycle, 400 pounds; consumption of gasoline, 8·4 gallons; mean speed, 20·2 miles per hour. 3. Bicycle, constructor, Werner; motor, Werner vertical type, with 2½ inch bore and 2⅞ inch stroke; weight of machine, 88 pounds; gasoline consumed, 6·7 gallons; mean speed, 24 miles per hour.

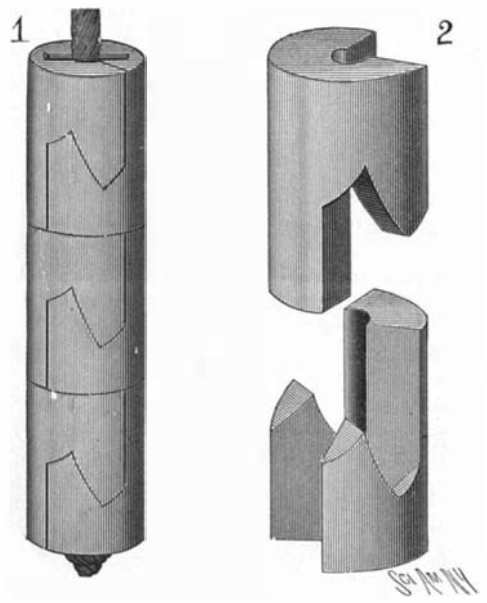
A CONVENIENT FORM OF SASH-WEIGHT.

The invention which forms the subject of the accompanying illustration is a new sash-weight patented by Eugene S. Crull, of Davenport, Iowa, which weight is made in sections so as to facilitate its adjustment on the sash. Fig. 1 is a perspective view of the device. Fig. 2 is a perspective view of the parts separated.

The two parts of which the weight is formed each consist of a body section with an open portion, and a branch, the branches fitting in the open portions of the bodies. Each part has also beveled flanking branches which interlock to sustain one part on the other. The parts have grooves which match to form a passage for the reception of the sash-cord.

It is evident that the number of weights can be increased or decreased at will to regulate the stress on the cord. When the proper number have been applied, the weights are held securely by a pin driven through the cord or a split washer clamping the cord and engaging the uppermost weight.

It is furthermore evident that this weight can be applied to the cord at any point between the ends, and that it is not necessary to string the cord longitudinally through the passage in the weight.



NEW SASH-WEIGHT.

One weight can be placed in position on top of another without disturbing the first weight. Merchants, by means of this invention, are enabled to carry in stock a uniform or standard article which can be used on different sashes. Hence the inconvenience of carrying in stock a large number of sash-weights of different sizes is obviated. The sections may also be used to build up the ordinary weight where the weight is inadequate properly to adjust the weight of sash.

Education in China.

Education of a certain type is very general, but still there are vast numbers of countrymen in China who can neither read nor write. There is a special literary class who alone know the literature of their country, to the study of which they devote their lives. There are boarding schools, day schools, and colleges. Examinations mainly confined to moral philosophy and literature are held in the prefectorial cities of each province twice in three years for the lower degree necessary as a passport to the public service, and of the six or seven thousand candidates who have come forward, not more than sixty can be admitted to the degree of Literary Chancellor. For the higher degrees, other examinations are necessary. There is a "College of Foreign Knowledge" at Peking, where European languages, mathematics, sciences, etc., are taught by European, Japanese, and American professors. There are besides many Christian mission schools, where the English language and lower branches of western sciences are taught. The government also maintains naval and military colleges and torpedo schools at the various arsenals to teach the young Chinese modern methods of warfare.

Electrical Notes.

An Italian electrician is said to have invented an electric cartridge for use as a substitute for dynamite, and other explosives. The composition used is made up of potassium carbonate and ammonium chloride, the proportions varying according to the use. The discharge is affected by the electric spark which produces an electrolytic effect upon the chemicals. The cartridges are said to be perfectly safe until subjected to the current.

The Baker Street (Waterloo) electric underground road, which is now being constructed in London, will probably be prolonged at its two extremities; instead of ending at Baker Street, it will go to Paddington Station, and at the other end will be prolonged from Waterloo to Elephant Place. When the line is completed, it is proposed to transport passengers over the entire length for four cents. To cover the same route by omnibus costs ten cents at present.

The use of electricity as an aid in agricultural pursuits has been tested on a considerable scale in Bavaria. The current is generated near the village of Schaftersheim, a distance of seven miles. The current is generated partly by steam power and partly by water power. The current is to be transmitted at a pressure of 5,000 volts to the surrounding villages, where it will be used for driving agricultural machines of various kinds. Special motors have been devised which can be easily operated by farm hands.

A new system of multiplex telegraphy has been devised by M. E. Mercadier, who has recently described the apparatus before the Société de Physique, of Paris. The transmitter is an electro-diapasm; the receiver is a telephone, and the relay is a differential telephone, which serves at the same time to receive all the signals sent by wave currents of different wave-lengths and to distribute them to the receiver circuits, containing twelve telephones constructed according to his system. The effect of the signals transmitted upon the receivers at the same end is neutralized by a combination of condensers and an artificial line. M. Mercadier gives an account of the practical results obtained by this system, which include the transmission of twenty-four messages at once over the same circuit from Paris to Bordeaux.

A new plan has been suggested by Mr. D. Tommasi for restricting the interception of wireless telegraphy messages. The idea is to use two transmitters of different ranges of action. The transmitter with the larger range is used for sending the message to the station for which it is intended, while the transmitter with the shorter range is employed in confusing the message within that range by an unmeaning series of dots and dashes. The range of a transmitter can fortunately be adjusted by altering the size of the spark gap, and, according to The Electrician, it should not be difficult to restrict the chances of interception to a zone of, say, half a mile. If, in addition, the spherical wave train could, by reflection or otherwise, be converted into a beam of the form of a search-light, the problem would be solved in a way.

Two engineers of Berlin have recently invented an apparatus which transmits to a distance the relief of a figure, either living or inanimate; the apparatus has received the name of "teleplastic." The relief may be received in full size, or may be enlarged or diminished at will, being quite exact. The transmitter consists of a frame containing a great number of metal rods placed side by side and movable back and forth. The receiver is a similar apparatus, in which the rods are moved by a series of electromagnets; when a relief is pressed against the rods of the transmitter a series of contacts is established, which cause the receiver to reproduce the relief by means of its rods, whose movement corresponds exactly to that of the transmitter. It is expected that this apparatus will render service especially in the pursuit of criminals, as it will give an exact reproduction of his features.

The lock gates at Ymuiden, Holland, are being operated by electricity. The rapid motion of the motor is converted into slow steady motion suitable for controlling heavy masses. Each gate is operated by means of a long connecting rod attached at about the middle of the width, the inner end of the rod being connected to a traveling carriage, to which motion is given by four endless chains passing from sets of sheaves. The train sheaves are operated by a train of gearing driven by the electric motor, the speed being reduced by a worm wheel and a pair of worms. The motor is placed in a separate chamber from the rest of the mechanism and is carefully cemented to prevent the access of moisture. The motor shaft passes through a fitted bearing in the wall, and there are three doors in the passage communicating with the chamber containing the operating gearing. The 145-horse power motors each control a gate, says The Engineering Magazine, and it is required that these shall open the gate in one and a half minutes against a difference of level of four inches. The motion being automatic is arrested at each end of the travel. The by-pass gates are also operated electrically, and the whole plant is under the control of a single operator.

THE GUARDIAN OF THE OYSTER.

BY DR. BENJAMIN SHARP.

This little crab, which we know as the oyster-crab, is about the size and shape of a pea, resembling somewhat a bleached-out spider. In Europe it is called the pea-crab, where it is rarely seen except by naturalists, for there it is not eaten by those who like oysters, while in this country it is well known, as we often see it floating upon the surface of an oyster stew. It is common on our coast, not only in oysters, but also in mussels and scallops.

The name "Washington-crab" has been suggested by some for the oyster-crab, as it was considered a great delicacy by our first president.

The crab has been known to naturalists from the earliest times of history, and the lively imaginations of writers on natural history have woven a curious network of stories about the life and home of this modest little animal.

Aristotle the Greek and Pliny the Roman, naturalists, believed that a definite relation or understanding existed between the shell-fish and its little lodger, and even went so far as to say that death would be the result if the crab should desert its host. The watchful crab, living within the home of the dull and stupid oyster, on seeing small fish approach, would wait until one more bold than the rest of his companions ventured within the open shell, then gently nipping the oyster, the doors would be closed and the fish held a prisoner. Thereupon the two, the host and his guest, would feed at leisure upon the body of the venturesome fish.

A very beautiful arrangement between these two—the blind and the lame—and a very pretty compact—but the cold eye of science saw that bivalves do not feed upon fish, but upon microscopic animals and plants, which live and float in the water, and that the little crab, whose limbs are so soft and yielding, could have neither the strength nor the power to pinch off morsels of food from an ordinary fish.

Another story, which held its own until late in the last century, was that this little crab played the part of the "King's Jackal," who hunted by night for his majesty the lion. It would sally forth to hunt and bring food to the helpless mussel or oyster, and on returning from the hunt, should it find the house closed, would give a cry, which was recognized by its host, the door instantly opened, and it was allowed to enter. Study has shown that the crab never leaves its home, and cannot cry, but as with the lion, who, in fact, often gets the food for the jackal, so it is that the little crab feeds upon the substances which are swept in by the current of water made by the bivalve, in order to bring in its own food, and to freshen the water for its respiration.

Again the crab was said to warn its protecting host from danger by a timely pinch, so that the doors could be closed against some crafty octapus or insidious star fish, and for which service the crab was rewarded by board and lodging.

This relation betweeen the crab and the bivalve was used by the ancients to illustrate how helpless is a man without a friend. Even Cicero is said to have used this simile, and we find the same idea expressed by the Egyptians in their hieroglyphic writings.

The oyster-crab, it is true, may act in such a manner that it warns the oyster of the approach of danger, but we scarcely believe that it is anything but a personal motive on its part. We nineteenth century folks do not believe that any intelligent understanding exists between the two. We have all seen how a crab will hurry back and forth on the approach of danger, will dart into the first crevice to escape its foe, and when in safety brandish its formidable claws with the greatest show of bravery. So the little Pinnotheres may, with the same instinct, run back and forth within the sensitive mantle of the oyster, and retreating push against its soft body, which will indicate to the slothful intelligence of its host that something is wrong outside, when it will discreetly close its shell, as the better part of valor.

The oyster-crab is about the size of a large pea, the body is globular, the legs small and weak, and it differs from nearly every other crab in having a perfectly soft yielding skin. In fact, it was always a "soft-shelled crab."

In the large "blue-claw" crabs of our coast the carapace, or shield which covers the body, is hard and firm, the legs and especially the pincers extremely rigid. On examination we find that this shell is made up of a fine horn-like skin, in which has been deposited a quantity of lime salts, making its covering almost as hard as marble. As the crab grows in size this armor, not being able to grow with the crab, is thrown off, while there is formed just under it a new soft skin. The shell cracks open, allowing the crab to crawl out of its old clothes, and for a day or two it is in a very helpless condition. It is at this time that they are captured and sold in our markets as "soft-shelled crabs." However, it is not long before the soft skin becomes as hard as it ever was, but during this period the crab is a very quiet, modest and retiring fellow, he has lost all his pugnacity, and is not found scurrying about for food or anything else. He retires from the sight of the world as much as possible and when his skin becomes hard again, like some persons under similar conditions, he sallies forth making himself very disagreeable to those who differ with him.

The little oyster-crab is in this sensitive thin-skinned condition throughout its whole life, and consequently always keeps hidden and as much as possible out of harm's way, within the protecting shells of some bivalve

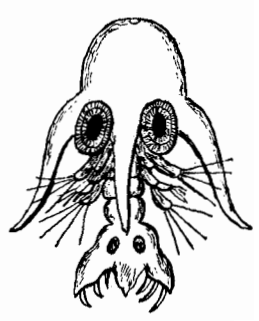
This state of affairs is a good example of the law of use and disuse, which we find so widely spread in the animal kingdom. When an organ or any part of an animal is not properly exercised, or becomes useless to its possessor, nature allows it to dwindle away and in time to disappear. One of these Pinnotheres, which lives, not in any shell-fish, but deep away in the water lungs of a sea-cucumber, is during the whole period of its adult life in total darkness: it loses its eyes and is totally blind—as blind, and for the same reason, as the blind fish of Mammoth Cave. The eyes being of no use in its dark abode, they degenerate and disappear; so it is with those crabs which are so well protected from their enemies by the hard shells of their hosts: they never get hard skins, but remain always soft and transparent. In fact, naturalists have given the name

THE OYSTER-CRAB.

"membrane-body" (Hymenosoma) to one set of these crabs, to indicate the soft and delicate nature of their skin.

Now, how does the crab get in, and does it ever get out of its shelly home? Oppian, who lived in the second century after Christ, and who placed his ideas in verse, tells us that the Pinnas and oysters open their shells to feed on mud and water, which they take into their shells. The little crab, wandering about in search of a home, sees the open shells and thrusts between them a small stone or pebble, and while this prevents the shells from closing, it creeps in with safety. This implies a great deal of craft and cunning on the part of the crab, and, were it true, the theory which accounts for its soft skin must be set aside, for during a certain time at least the crab must wander about, as do other hard-shelled crabs, unprotected, while searching for a home.

The crab gets into its future residence at a very early period of its life, when, indeed, it looks so unlike its parent that one would not believe that any relation existed between them. When the eggs of crabs are hatched, a curious little object comes forth, known to naturalists as a Zoea, and they speak of this period as the "Zoea stage." This form is so unlike any known crab and always found freely swimming in the water, and never on the bottom, that when it was first dis-



A ZOEA.

covered it was supposed to be an adult animal, and was named Zoea. By raising crabs from the egg, it was found that this Zoea was only the childhood of nearly every crab or lobster, and as it grew and shed from time to time its transparent skin, it gradually came to look more and more like its parent.

By the discovery that the eggs of barnacles passed through stages common to most crab-like animals, naturalists found that they did not belong to that great group including the snails, clams, and cuttle-fish, where they had been placed prior to 1829, but belonged to the group which includes crab, lobster, and shrimp-like animals, but greatly modified in the adult state, to suit their habits and surroundings.

The tiny Zoea, not larger than a pin's head, leads for a time a perfectly free life in the water, swept hither and thither by the currents of the sea: as it gets older, it finds its way to some open oyster and then it is swept within its shell by the current of water which passes over the gills and on to the mouth. It here gives up its wandering life and soon grows to the adult form, shedding from time to time, as with all crabs, its transparent skin. We find, moreover, that it is only the female which lives in the oyster. The male Zoeas do not remain thus protected, but prefer the freedom of a life upon the ocean bottom, only visiting its mate in the oyster at certain seasons of the year. This male form is not soft, like its well housed mate, but, as we would suppose from its free life, has a fairly hard shell, like other crabs.

The Pinnotheres are found all over the world, wherever we find oysters, mussels, or scallops, from the Antarctic Ocean to the frozen north; but it seems that they are only used as a table delicacy by the American people. In the West Indies there is an oyster which attaches itself to the long roots of the mangrove trees. When Columbus first saw them, he was greatly astonished to find, among the many wonders of the Western world, oyster bearing trees, and having read that pearls were formed in oysters by drops of dew falling into their open mouths, reported to the credulous Europeans that the mangrove oyster must yield an abundant harvest, for the dew was so heavy in these tropical islands. Dr. Patrick Browne, however, tells us, in 1756, that the oyster crab is very common in the mangrove oyster, and such "as eat them do not think them a bit the worse for being accompanied with some of these crabs, which they swallow with the [shell] fish."

These crabs are quite common in the true pearl oyster of the Indian and Pacific Oceans, and there is a specimen of one of these shells in which a male is imprisoned in the substance of the shell and covered over with a layer of mother-of-pearl. The little fellow probably entered the oyster in search of his mate, and, not finding her, wandered about and finally passed between the mantle of the oyster and the shell, where he was finally enshrouded in mother-of-pearl.

There are about seventy-five kinds of crabs belonging to the oyster-crab family, all more or less related. All of them are small and of a retiring disposition. Some do not live within the shells of a protecting bivalve, but remain on the sea bottom under stones and hidden within small holes. Naturalists can, by the study of these animals, trace the different steps from the free crab, hiding in holes and crevices, to those which enter the open mouths of oysters, where, being protected from the attacks of enemies and having its food brought to it by the exertions of its host, it spends its entire life.

But perhaps the most curious habit found in any crab is that of a near relation of the oyster-crab, which we may call the "Coral-crab." This very small animal, after the free Zoea life common to most crabs, settles down in the fork of a growing coral and waits for a home to be built up around it. As the coral grows, the crab is slowly surrounded by the hard skeleton of the polyps. A very wonderful equilibrium is now formed. The crab must grow just as fast and no faster than the coral, for if it did not keep pace with the growth of the coral it would be soon walled in and no room allowed for its future growth. So, until the crab has reached its full size, about one-quarter of an inch, it lies in a cup-shaped hollow, with its opening on a level with the coral-polyps. When the full growth of the crab has been attained, the coral-polyps would now certainly close in over the little crab, and make it a prisoner, as did the pearl oyster, but the currents of water made by the crab in breathing-force the polyps to grow slanting from the mouth of her cave, so that in time a long funnel-like opening leads past the growing polyps to the body of the little crab.

We have here a beautiful adaptation. The crab chooses its own place among the coral branches, and then gently forces the workmen to build it a safe and comfortable home.

Replacing a Propeller at Sea.

The steamship "Border Knight" was disabled at sea by losing a propeller. The tail shaft broke short off at the boss and dropped to the bottom of the ocean. The machinery was immediately stopped and for safety the steam was run through the winches instead of using the automatic blow-off. Very interesting repairs were then made. The "Border Knight" carried only water ballast and was 2,000 miles from New York. There was a spare tail shaft and propeller on board. Of course, it would not have done to have pulled the broken tail shaft back into the tunnel, as this would have opened a hole below the water-line. The engineer, whose name is Gerrie, made a plug just the size of the shaft hole. He was then lowered over the stern with a rope, and seated himself on the pintle of the rudder. He then succeeded in inserting the plug and driving it home. The broken tail shaft was then removed and the water was pumped from the stern bal last tanks. It was necessary to drive the plug still further in, and this was accomplished by the heroic engineer, though sharks were following the vessel in considerable numbers. The spare tail shaft was gotten into position and the spare propeller, which weighed eight tons, was lowered over the side of the boat and slewed around until it was in proper position. The tail shaft was then pushed out through the hole in the stern, displacing the plug. The propeller was then worked over it to the shoulder of the boss, and the key was driven in. The forward section of the shaft was then replaced, the couplings were made, the bolts tightened, and after four days and three hours' work the vessel proceeded upon her journey.

THE HAMBURG-AMERICAN LINER "DEUTSCHLAND."

Of the six decades which cover the life of Transatlantic steam navigation, the latest is certainly the most remarkable. The period from 1889 to the present year may appropriately be called the "twin-screw period," for it was in the year of the last Paris Exposition that the Inman and International Line, predecessor of the American Line, placed in service those two magnificent ships, the "City of New York" and the "City of Paris," which were built on the Clyde from plans drawn by designer Biles. In several respects they marked a distinct departure from all previous vessels. They were the first to embody twin screws driven by separate engines placed in two distinct water-tight compartments. They marked, moreover, a great advance over previous ships in size, speed and accommodation; and from the very first they were a brilliant success, the "Paris" early in her career breaking the record for the Transatlantic trip and crossing from New York to Queenstown in considerably under six days, at an average speed of over 20 knots an hour. The following year the White Star Line placed in service the "Teutonic" and the "Majestic," sister ships of 13,800 tons displacement and 19½ knots speed. Although somewhat smaller than the "City of Paris," these vessels were 25 feet longer, their length over all being 585 feet.

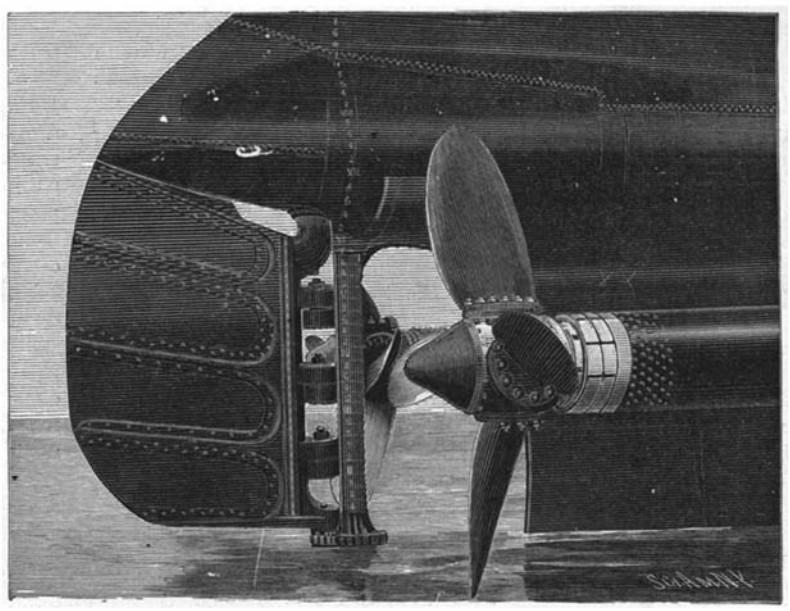
Three years later the Cunard Company regained the leading position in respect to size, speed and accommodation by adding to their fleet the celebrated "Campania" and "Lucania." Throughout the history of the Transatlantic service there had been no instance of such a great increase over the dimensions of previous vessels as was marked by the advent of these handsome vessels. They were 625 feet long, or 65 feet longer than the "City of Paris," and 65 feet in beam, with a displacement of 19,000 tons, or 4,000 tons more than the last named ship. With an indicated horse power of 30,000, the "Lucania" has crossed the Atlantic from Sandy Hook to Queenstown in 5 days and 7 hours, at an average speed of 22·1 knots per hour.

In 1895 the American Line, which under an Act of Congress had already purchased the "City of Paris" and the "City of New York," placed in service those two well-known vessels the "St. Paul" and the "St. Louis." Each may be described as an improved "City of Paris," retaining the best features of that vessel and embodying the many improvements in construction, motive power, and comfort for the passengers, which had marked the intervening six years since the launch of the latter vessel. They are 554 feet in length, 63 feet in beam, and have a displacement of 16,000 tons. The "St. Paul," whose engines indicate 20,000 horse power, has made the passage to Southampton at an average speed of 21 knots an hour. The four vessels of this line, it will be remembered, took an active part in the naval operations of the Spanish-American war and proved invaluable, both as scouts and in the transport service, for both of which duties the size, speed and coal endurance rendered them particularly well suited.

Two years later the North German Lloyd Company despatched on her maiden voyage to this city the "Kaiser Wilhelm der Grosse," a vessel which is naturally compared with the "Campania" and "Lucania." She is 24 feet longer than those vessels and possesses 1 foot more beam and 1,000 tons more displacement. From the very first she was a notable success, and up to the advent of the "Deutschland" she held all records for average sea speed and for distance traveled in 24 hours. Her fastest trip to Southampton was made at an average speed of 22·62 knots per hour, and she has covered the enormous distance of 580 knots in 24 hours.

After an interval of two years, the White Star Line added to their fleet a huge steamer that not only far exceeded in dimensions any existing liner, but both in length and displacement was greater than the "Great Eastern" itself. The "Oceanic" is 704 feet in length, 68 feet in beam, has a displacement of 28,500 tons, and with an indicated horse power of 28,000 has crossed the Atlantic at an average speed of 20·5 per hour.

In the latest Transatlantic liner, the "Deutschland," which forms the subject of the accompanying engravings, the Hamburg-American Company aimed to produce, if not the largest, at least the fastest, most powerful, and best appointed vessel, in the Atlantic service. She was built by the Vulcan Iron Works, of Stettin, Germany, who were the builders also of the "Kaiser Wilhelm der Grosse." She is not so long as the "Oceanic" by 18 feet and she has one foot less beam and 5,500 tons less displacement. The "Oceanic," however, was not built for extremely high speed, but she was constructed with a view to carrying besides her passengers a large amount of cargo. The "Deutschland," on the other hand, is an ideal Atlantic racer. Her lines are exceedingly fine. Looking at her when she is in the dock, one is struck with the fact that the almost parallel lines amidships which exist in other fast steamships are wanting in the "Deutschland," for she begins to fine away toward the ends from amidships, reminding one in the beauty of her lines of the model of a steam yacht. In the engine room, also, she greatly exceeds the "Oceanic." She is driven by two sets of six-cylinder, quadruple expansion engines working on four cranks and balanced on the Yarrow-Schlick-Tweedy system, which is designed to, and very effectively does, reduce vibration. The hollow nickel-steel shafting for each engine is 130 feet in length and 2 feet in outside diameter, and the propellers, which are of bronze, are 23 feet in diameter. Steam is supplied by 16 Scotch boilers, 12 of which are of double-ended and the other four of the single-ended type. The working steam pressure is 220 pounds to the square inch. When the boiler room is in full swing, the firemen have to feed coal continuously to no less than 112 separate furnaces. The vessel, it is almost needless to say, is constructed on the usual water-tight bulkhead principle, the hull being divided into 17 water-tight compartments by means of a longitudinal bulkhead and numerous transverse bulkheads. There is also the usual cellular bottom extending throughout the length of the ship and rounding well up into its sides.



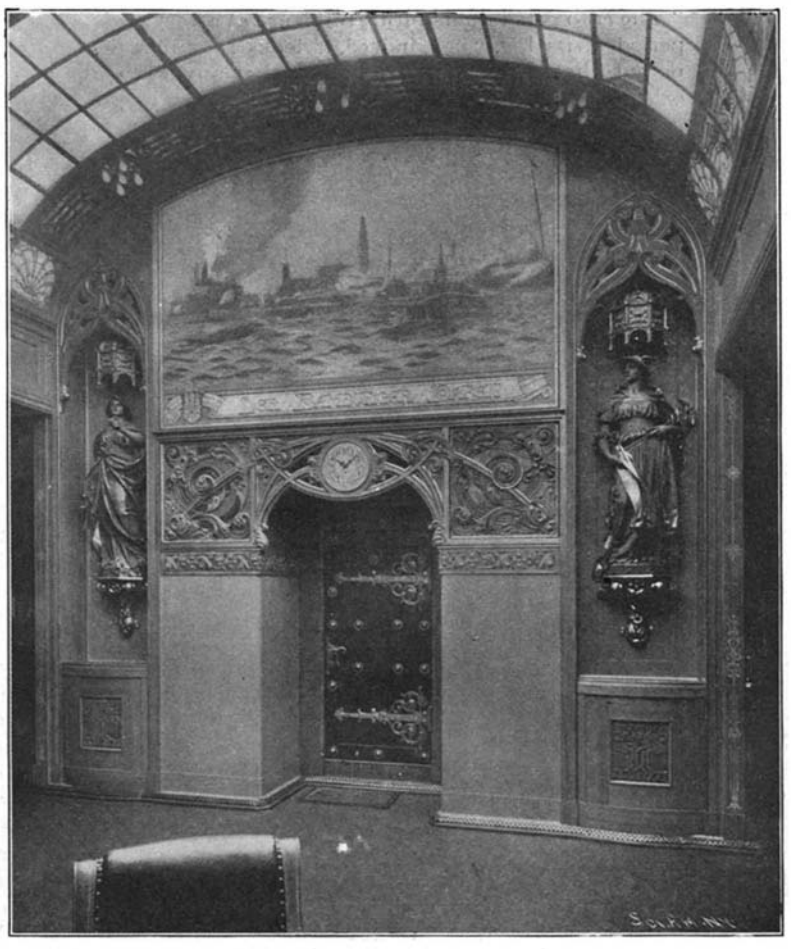
THE BRONZE PROPELLERS OF THE "DEUTSCHLAND."
Diameter, 23 feet; weight, 30 tons.

A DECADE IN THE DEVELOPMENT IN THE TRANSATLANTIC STEAMSHIP.

	Date.	Length. Feet.	Beam. Feet.	Displacement. Tons.	Horse Power.	Speed. Knots.
City of Paris	1889	560	63	15,000	20,000	20·25
Teutonic	1890	585	57½	13,800	18,000	19·50
Campania	1893	625	65	19,000	30,000	22·1
St. Paul	1895	554	63	16,000	20,000	21·0
Kaiser Wilhelm der Grosse	1897	649	66	20,000	28,000	22·62
Oceanic	1899	704	68	28,500	28 000	20·5
Deutschland	1900	686	67	23,000	35,640	23·0

It will be noted that the accommodation of the "Deutschland" is mainly restricted to first and second cabin passengers, provision being made for 467 first cabin, 300 second cabin and 300 third-class passengers. A novelty in the first cabin accommodation is a separate playroom for children and a gymnasium, while another innovation is a grill room, situated on the boat deck at an elevation of about 40 feet above the sea, where passengers may obtain a meal at any hour of the day. The general scheme of decoration may be gathered from the accompanying photographs, which we are enabled to present by the courtesy of Mr. Emil L. Boas, General Manager of the Hamburg-American Line. The dining saloon is a noble apartment reaching across the full width of the vessel and lighted by large port holes at the sides and through a large light-well, terminating in a dome covered with cathedral glass. One of our photographs, taken from the gallery of the deck above the dining saloon, shows three separate decks of the vessel; that on which the dining saloon is placed, the deck above, from which the photograph is taken, and above that the deck on which the ladies' parlor is located. This photograph is of particular interest as giving an impressive idea of the true proportions of a modern Transatlantic liner. Two others of our photographs are taken in the first cabin smoking-room, which is located in the after part of the vessel. This room is of great height, not less than 20 feet to the roof of the dome, and the walls are decorated with paintings of New York harbor, the port of Hamburg, and other localities connected with the service of the ships of the line. Impressive evidence of the size of such a ship as this is afforded also by the fact that the promenade deck gives an unobstructed walk of 520 feet, or over 1,000 feet circuit.

In our last issue we gave some particulars of the maiden trip of the "Deutschland." On her return trip to Plymouth the vessel broke all previous records, covering a distance of 3,085 knots, at an average speed of exactly 23 knots an hour. The ship's log records that fog was experienced on two days of the run; and but for this the average speed would have been greater, a few hours being lost through slowing down. During the homeward trip the engines indicated 35,640 average horse power. One marked advantage of high speed in a vessel like the "Deutschland" is that she is enabled to make a round trip to Europe in three weeks, thus making a sailing from each port once in three weeks, instead of once in four or five weeks, as is common with slower vessels. Of course, this throws a much heavier strain on the ship and engines, and the vessel's life is likely to be of less duration; but it is considered by the company that in view of the rapid development in the size and speed that is ever taking place in Transatlantic steamships, such a vessel as the "Deutschland" will not begin to deteriorate until it is desirable to replace her with a more up-to-date ship.



"DEUTSCHLAND"—MAIN ENTRANCE TO SMOKING-ROOM.

Three Hundred and Fifty Thousand Dollars for a Patent.

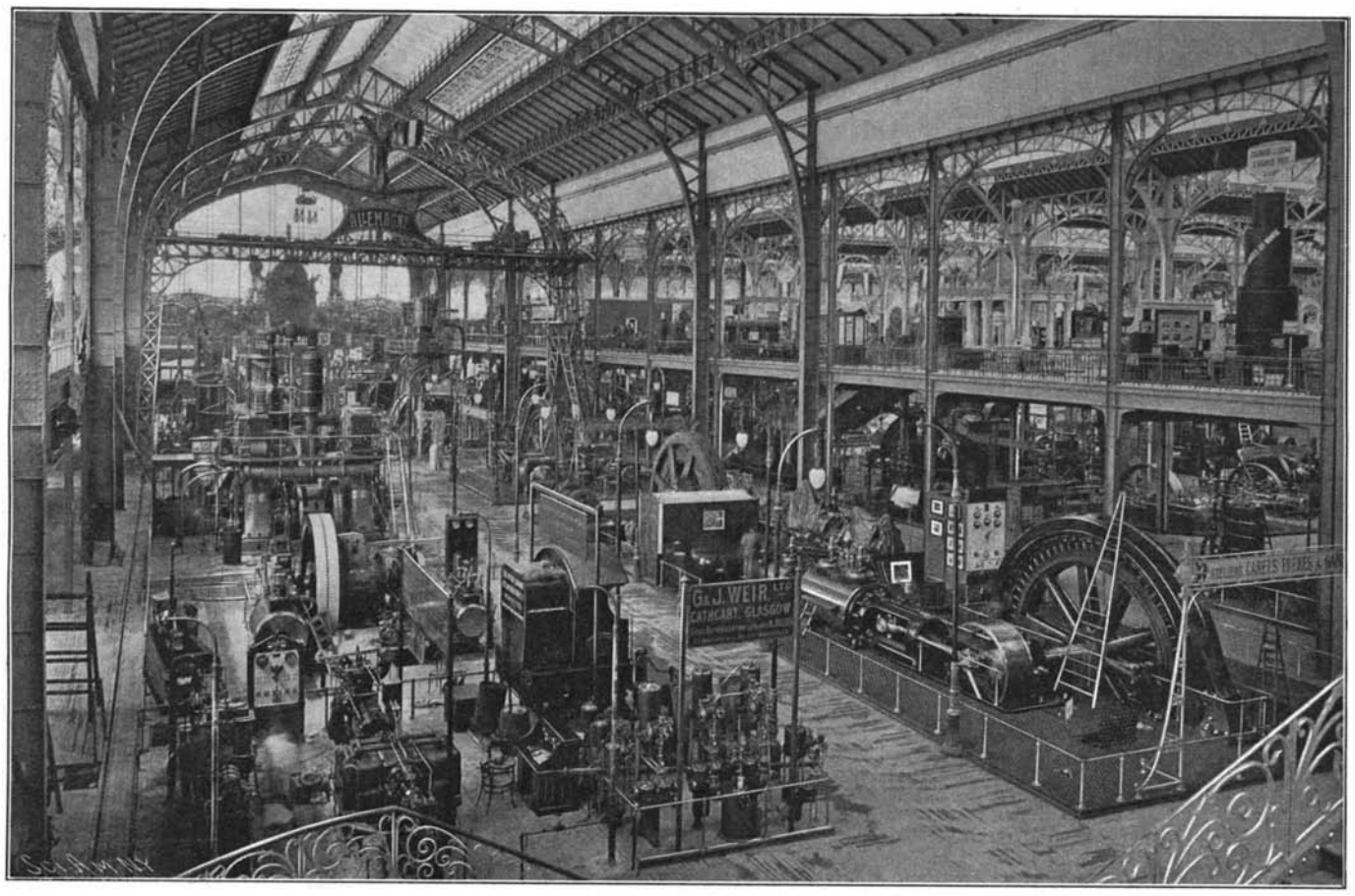
The German government has just paid $350,000 to the Strowger Automatic Telephone Exchange, of Chicago, for the patents and rights to manufacture and use that company's automatic switch. A trial of it was made in Berlin in the early part of the year, and the first payment of $150,000 was made. The contract was for a 200-instrument exchange in the government service, to be used for six months, and if at the end of that time it proved satisfactory $500,000 was to be paid. At the expiration of the second month the government asked for an extension of the terms of the contract in order to permit the installation of 200 more automatic instruments in private institutions, etc., in Berlin.

According to M. H. Coupin, the alkaline herbs are poisonous in their influence on plants in proportion to the atomic weight of the metal, in the following order: calcium, strontium, barium, and strontium are poisonous Most salts of barium especially so, as also are the chlorates of lime and potassium.

THE POWER GENERATING PLANT AT THE PARIS EXPOSITION.

BY F. P. MANN.

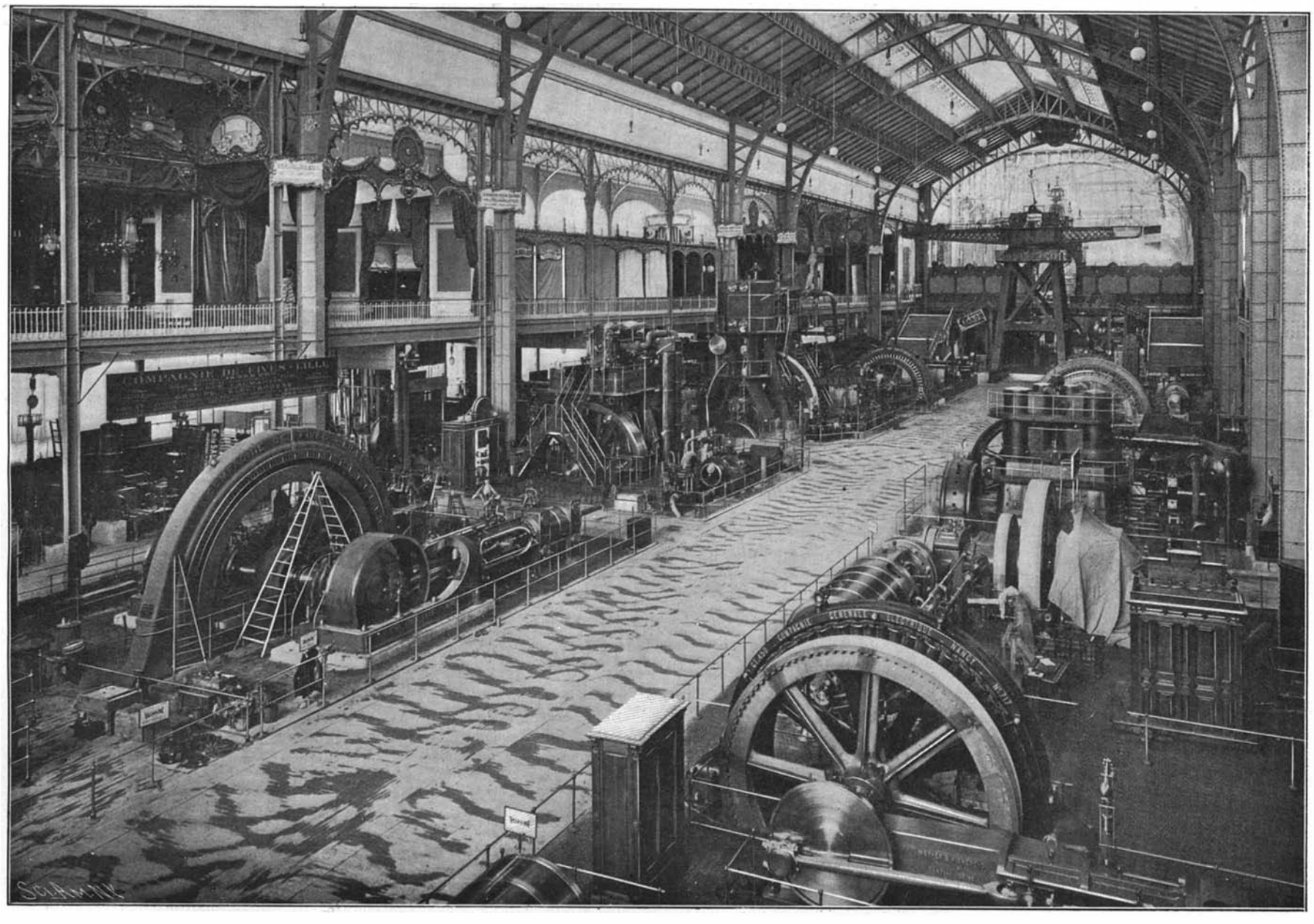
The main dynamo rooms of the Paris Exposition form part of the Electrical Palace, and lie on either side of the central portion of the building; here are to be seen the large engines and dynamos of different types which supply the lamps and motors throughout the buildings and grounds, at the same time serving as an exhibit of the most improved engines and electrical machinery. At the present Exposition a considerable amount of power is required to operate the motors used in the different exhibits, the electric system of power distribution is used exclusively, doing away with small steam engines. The total amount of energy used for lighting and power reaches 30,000 horse power, which is furnished by 38 generating groups; the total capacity of the steam engines is about 36,000 horse power.



FOREIGN SECTION OF THE POWER GENERATING PLANT OF THE PARIS EXPOSITION.

The dynamo room shown in the first illustration is that occupied by the engines and dynamos of French construction; the second dynamo room contains those of foreign makes; there are also two corresponding steam-generating plants situated in the rear of these, containing two rows of boilers erected on each side of a central passage. The dynamos and engines are supported on massive foundations in concrete, going down to a depth of fifteen feet. The piping from the boilers to the engines passes underground, and the foundations have been built to accommodate the condensors and accessories, which are thus nearly all placed below the floor level. In the French dynamo room the first generating group to the left has been constructed by the Fives-Little Company, of Paris. The engine is cross-compound, of the Corliss type, making 80 revolutions; it has a capacity of 1,200 horse power. The dynamo is of the three-phase alternating-current type, working at 2,000 volts, with a capacity of 800 kilowatts. The next generating set is furnished by the Alsatian Company, of Belfort; it has a large upright compound engine of 1,200 horse power; the main shaft carries a heavy fly-wheel on one side and on the other a direct-current dynamo of 680 kilowatts, giving 500 volts. Next to it is an upright compound engine, the largest in the section, of the Allis-Corliss type, with a capacity of 2,000 horse power at 75 revolutions. The dynamo, placed in the center between the two cylinders, is of American design, having been constructed on the Thomson-Houston system by the Postel-Vinay Company, of Paris. The dynamo is one of the largest at the Exposition, giving 1,000 kilowatts at 5,000 volts. The fly-wheel is placed on the inside next the dynamo; the engine is surrounded by two platforms, which are reached by a double staircase. In front of the two latter groups have been installed two small generating sets using Laval steam turbines to drive the dynamos; these turbine sets are used to a considerable extent in the French navy, being constructed by the Maison Breguet, of Paris. Farther on is another large generating group; the engine, of 700 horse power, is furnished by the Pignet Company, of Lyons, and the dynamo, of the Grammont type, is a triphase alternator working at 2,200 volts.

The foreign dynamo room, shown in the second illustration, presents many novel and interesting types of machines. The British section, shown in front, to the left, contains two Parsons steam turbines with direct-current dynamos. Back of these is a large cross-compound engine built by Robey & Company, of 500 horse power, with a direct-current dynamo of 300 kilowatts at 250 volts. The engine has a new type of electric governor, which keeps a constant speed at all



FRENCH SECTION OF THE POWER GENERATING PLANT AT THE PARIS EXPOSITION.

loads. Near it is the large upright engine of the Galloway make, giving 680 horse power at 105 revolutions. The dynamo, mounted on the shaft between the cylinders, has a capacity of 500 kilowatts; it has been built by Mather & Platt, of Manchester. A still larger upright engine, triple expansion, is that of Willans & Robinson, giving 2,000 horse power; the dynamo is furnished by Siemens Bros. & Company, of London. The German section, at the farther end of the building, contains four of the largest generating groups at the Exposition. Two of these may be seen to the right, the first being the large Borsig engine of 2,500 horse power, carrying a Siemens & Halske alternator of 1,250 kilowatts. The engine is of remarkable size, measuring 38 feet from the ground to the highest point; it has a total weight of 350 tons, the foundation plate weighing 60 and the flywheel 41 tons. Next to it is a large triple-expansion engine of 2,000 horse power, carrying on one side a Schuckert alternator and on the other a direct current dynamo, the total representing 1,200 kilowatts. Opposite to it is a similar generating group of about the same capacity, with Lahmeyer dynamos. The remaining set consists of a cross-compound engine built by the Augsburg Machine Company, carrying an alternator of large diameter of the Helios Company, Cologne, giving 2,000 kilowatts. The external diameter of this machine is nearly 30 feet and the diameter of the revolving field 25 feet.

The machines of the Belgian section may be seen on the left; in front is a Carels engine of 1,000 horse power, with a Kolben alternator, and farther on an engine of like capacity, built by Van den Kerchove, of Ghent, with an alternator of 600 kilowatts, giving 2,200 volts; the third group has an engine of the Bollinckx make, of 1,200 horse power, and a dynamo built by the Electric and Hydraulic Company, of Charleroi. Besides the groups in the main dynamo room are those of the Swiss, Austro-Hungarian, Italian, and other sections, which occupy the neighboring spaces. In the main dynamo room is a traveling crane of 25 tons, built by Carl Flohr, of Berlin; it spans the building, running on a track at either side. The carriage running along the horizontal beam is operated by three phase motors.

Statistics of Mining Production of Great Britain.

The figures for the mining production of Great Britain for the last two years have recently been published. In making the estimates the mines have been divided into three classes, coal, minerals and stone quarries. The figures for 1898 and 1899 are given as follows, in millions of tons:

	1898	1899
Coal	202·0	220·0
Refractory clay	2·8	2·9
Iron ore	7·9	7·8
Schist	2·1	2·2

The figures show an increase in the production of coal of 8·9 per cent over that of 1898. More than one-half of this increase comes from the mines in the south of Wales, where a prolonged strike diminished greatly the figure for 1898. The number of persons employed in this class of mines in 1899 has been 729,009, of which 583,009 are employed underground; this represents an increase over 1898 of 22,115 persons. The mines of the second class give the following figures in millions of tons:

	1898	1899
Gypsum	134	158
Iron ore	2,167	1,957
Limestone	556	590
Rock salt	183	190
Slate	178	179
Zinc ore	24	23

The number of persons employed is 35,187, of which 20,618 are underground. The total production of iron ore is thus nearly 10,000,000 tons. Iron ore is also found in the quarries, which in 1898 gave more than 4,000,000 tons; the figure for 1899 is not yet given. The importations of iron ore amounted to more than 7,000,000 tons for 1899, and thus the total consumption for the year is at least 21,000,000 tons.

The Death of Jasper R. Rand.

We regret to note the death of Jasper R. Rand. Mr. J. R. Rand and his brother became interested in rock drills when they were in the pioneer stage, with at most a small and uncertain future before them. Rock drills were among the first American machinery products to find recognition among foreign engineers, and they are to-day at work in nearly every country on the globe where the mining industry has passed beyond the most primitive stage.

THE question as to whether strontium and barium can replace calcium in plants has been made the subject of inquiry. Dr. M. Suzuki gives a contribution to this question in a recent number of The Bulletin of the College of Agriculture of Tokio. Experiments were carried out with several species of plants and in soils containing varying amounts of calcium; the results show that strontium and barium can never replace calcium, as they are strongly poisonous, although the poisonous action may be lessened to a certain extent by the addition of lime salts.

Science Notes.

Messrs. Macfadyan and Rowland report that they have exposed various micro-organisms to the temperature of liquid air for some days without finding that the vitality of the organisms was impaired in any way, except that in one or two cases their growth was slightly delayed.

Dr. Donaldson Smith, the Philadelphia explorer, recently reached Cairo after a remarkable journey to Lake Rudolf and Stefanie. From Uganda he was conveyed down the Nile from Khartoum in an Anglo-Egyptain gunboat, the first vessel to traverse the Nile since the cutting of the sudd. Dr. Smith has accomplished considerable interesting work in hitherto unexplored regions.

Dr. J. J. S. Lucas has developed a system for the Nordrach open-air treatment of consumption, which possesses several points of interest. A maximum amount of fresh air is prescribed, together with a strict but generous diet. The fresh air seems to be an indispensable aid to any successful treatment of tubercular disease. The work is entitled "Nordrach at Home," and is published at Bristol, England.

According to Herr Reinmann, there is no relation between rancid paste and the odor of butter and the quantity of free acid found in it. The greater the amount of caseine and of milk sugar in butter, the more quickly does it become rancid. It does not appear that light and air exercise any direct influence upon the process. Butter made from sterilized cream will rarely become rancid, but if brought into contact with rancid butter it will turn in a few days.

Several educational awards to the United States have been made at the Paris Exposition. In three instances distinguished merit was recognized in the case of individuals; Prof. H. A. Rowland, of Johns Hopkins University, Prof. Nicholas Murray Butler, of Columbia University, and Melvil Dewey, of the University of the State of New York. Grand prizes were awarded to the University of the State of New York, the Congressional Library at Washington, Harvard University, University of Pennsylvania, Johns Hopkins University, and the American Library Association.

A new record for high kite flying was established at Blue Hill, Boston, July 19, when a height of 15,900 feet was reached with a line of six kites in tandem. Five were an improved box pattern and one was a rib kite. The greatest height was reached with four and three-quarter miles of steel piano wire used as a flying line. The temperature registered by the automatic instrument was 30°; at the sea level it was 80°. The velocity of the wind was 26 miles an hour and the atmosphere was very dry. It was difficult to see the highest kite from the Observatory without the aid of a telescope.

Injudicious restorations have awakened storms of complaints from the time of Ruskin down. There have been, however, many cases where restorations have not only been justified, but have been carried out in a thoroughly satisfactory manner. The church of Santa Maria della Spina, on the Lung'Arno at Pisa, was taken down about two years ago, as it was in a most dilapidated state, and was re-erected at a higher level, so as to protect it from the damp of its original position. Not only was the masonry of the walls replaced stone by stone in the proper place, but every fragment of old carved work was preserved, and where small pieces had been lost, they were reproduced with an accuracy which would please archæologists.

The Hudson Bay Company officials have received word that Indians, hunting on the east coast of Hudson Bay north of St. George, discovered some wreckage that may possibly have been that of the Andreé expedition. It is stated that they found last spring a vast quantity of wreckage and the bodies of two men and one man who was dying. The language which this man spoke was not English, and the Indians were not able to understand it. They described the car and other wreckage accurately. The Hudson Bay officials seem to be convinced that it was the Andreé expedition, and have sent out a party guided by the Indians to find and bring back evidence to establish the truth of these statements.

Vanillin is developed in the leaves of the vanilla plant by a ferment, or by mineral acids. It has now been proved that a similar combination exists in the fruit. Busse obtained from the botanical Gardens of Berlin an unripe vanilla pod which was ground and extracted with alcohol at normal temperature. The extract was treated with lead acetate and the excess of lead was removed by hydrogen sulphide, and the alcohol removed from the filtrate by heat. A portion of the aqueous fluid was gently heated with a small percentage of sulphuric acid, another equal portion with hydrochloric acid, and a third with a few grains of emulsion and warmed. In all three cases the odor of vanilla was very strong. The product was purified by dissolving in ether and washing the solution with water; on evaporation of the ether a pure vanilla odor was obtained.

Engineering Notes.

Large deposits of the rare earths, s chuas zirconia, thorium, ittrium, etc., have been located in Central Tasmania.

A project is on foot to connect the railways of Greece with those of Turkey, so as to connect Athens with Europe by rail.

The British consul at Copenhagen calls the attention of persons trading with that country to the necessity of registering their trade marks in Denmark.

The opening of the new freight station in the Pennsylvania Avenue Subway at Twentieth and Hamilton Streets, Philadelphia, practically completes the Reading Subway, which was fully illustrated in the SCIENTIFIC AMERICAN for October 21, 1899.

An engine shaft with its attachments weighing 240 tons was recently raised with the aid of screwjacks and overhead crane at the power house of the Metropolitan West Side Elevated Railway in Chicago. The shaft belongs to one of the big engines operating the dynamos. The rotation of the flywheel caused the pillar blocks to become loose and approach each other. The shaft was raised in order to put in new work so that the foundations of the engines will be stable.

Dr. Goldschmit has devised a new method of welding rails, in which he makes use of the great heat developed by aluminium when it combines with oxygen furnished by a metallic oxide. In the process of welding which he uses at present, the ends of the rails are brought together in a crucible, in which is then placed a quantity of finely divided aluminium and iron ore. The rails, previously planed at the ends, are pressed together tightly and the mixture ignited; the heat produced is sufficient to make a good weld, the more so as the high temperature causes an expansion of the rails and brings them firmly together.

Prof. Lunge, at a recent meeting of the Society of Chemical Industry, at Liverpool, made some interesting remarks on sulphuric acid manufacture. He stated that we are confronted with the greatest revolution which has taken place since the acid became a commercial product. This is the total abolition of the vitriol chamber and of the use of nitrous fumes as oxygen carriers. By the use of the catalytic power of platinum, perhaps also by that of ferric oxide and other substances, a great many industries will probably be able to make their own sulphuric acid by the new process, as it is simpler and can be successfully carried out upon a small scale.

An English inventor has devised an apparatus whereby the sides of railway cars may be thoroughly washed and cleansed without the use of hand labor, which is now commonly employed for this purpose, says The Railway Review. The device comprises rotary brushes adapted to be moved into engagement with the sides of the car, shields partially inclosing the brushes and movable therewith, spraying pipes carried by the shields and flexible connections between the pipes and a water-supply pipe. The machine is mounted in a shed or other enclosing structure located on a track siding, through which the cars may be conveniently passed. As the cars are drawn slowly between the washers power is applied to rapidly revolve the circular brushes, and at the same time water is turned into the shields to aid in removing the dirt.

A curious and unexpected development has arisen in connection with the cutting off suddenly, at Assouan, on the Upper Nile. The large volumes of water which were liberated had been stagnant for many months, and, therefore, possessed no free oxygen; consequently the fish in the river at Assouan have been destroyed by the hundreds of thousands. The chief of the engineering staff reports that there are over 1,000,000 dead fish ranging from two or three inches to six or seven feet in length, lying exposed to the sun within one hundred yards of his office. The odor exhaled by the decomposition of these fish by the torrid sun is nauseating in the highest degree. To accelerate the gravity of this situation there is no other drinking water available. Fortunately, however, no virulent epidemic has yet broken out among the inhabitants as a result of drinking such polluted water.

According to a compilation made by the Land Office of the State of Washington, 15,858 square miles in that State were originally covered with merchantable timber—fir, cedar, hemlock and spruce, says The New York Evening Post. One-fifth of this area has been ravaged by fire, 22½ per cent has been cut, and the remainder, or 9,039 miles, is covered with standing timber. Upon this timbered area there is estimated to be standing 103,503,576,000 feet, board measure, which in itself is sufficient to supply the saw mills of the United States for four years under the present rate of cutting. By a comparative table the report shows that with the single exception of the redwood forests of California, the forests of Washington are the densest, heaviest, and most continuous in the United States. With the exception of a few prairie openings and where the timber has been removed by fire or the axe, they cover the country as a thick mantle from high up on the Cascade range westward to the shores of the Pacific.

CLEVER FEAT WITH THE CAMERA.

The enterprise of the man with the camera is proverbial; and, although his zeal is not always sweetly tempered with discretion, it must be admitted that the picture-loving world would be the poorer were the click of the kodak no longer heard in the land.

The camera is apt to be a ruthless invader of privacy, and the indignant subject of an extemporized and unconscious sitting will have the sympathy of all well-minded people. Our readers will agree, however, that the intrusion which resulted in the accompanying photograph was eminently proper, although, if we may judge from the subjoined extract from the letter of our correspondent, E. W. Gaines, the mother partridge herewith pictured on her nest was of quite another mind: "The partridge nest was down in a ravine, about twenty feet below the traveled road, in the cemetery in Greenfield, Mass. The mother bird had made her home just at the foot of a tree, and there laid fourteen eggs, on which she was contentedly sitting when discovered. My camera was a Premo, 4 × 5, with a Darlot lens. I set it up about three feet from the nest when the mother bird was away; then, with the bulb in my hand, I lay down, covered myself with leaves, and waited. In about half an hour the bird returned with much spitting and scolding. As I kept perfectly still, she became convinced that her alarm was unnecessary, and settled herself on the nest. I opened my shutter and gave her just a bit of time; then closed it, and the deed was done."

Photographs Copyrighted by E. L. Gaines.

SNAPSHOTS OF A SITTING PARTRIDGE AND HER NEST.

Important to Poultry Raisers.

The American Game Keeper, which from the name should be authority on the fowl subject, gives the following simple directions for protecting setting hens against lice and mites, which is their besetting annoyance: A cheap and easy method of destroying these pests and keeping them from the setting hens, it says, is to place one or two of the camphorated balls (such as those displayed in the windows of drug stores) in each nest. They cost very little and by putting them in the nest the work is done, a single ball lasting through the entire warm season.

Every time the hen goes on the nest she imparts heat to it, and a portion of the camphor ordorizes her body and also the material of the nest; lice giving it a wide berth. One of the balls, if placed in a vial of sweet oil, and applied to the heads of the fowls and chicks, on the shanks or under the wings, will also prove serviceable in preventing scaly-legs and destroying the large lice.

For chicks only use one or two drops of the mixture, as grease of any kind is injurious to chicks.

If preferred a mixture may be prepared by using 1 part lard oil, 1 part linseed oil, a few grains of camphor and 3 or 3 drops of oil of sassafras, shaking the mixture well before using.

Whitewash the top and sides of the hen house and use plenty of carbolic acid in the wash; put it on thick over the roosts, nests, and every board, to kill the insect eggs, lice, mites, and germs of contagious diseases, if there is any, and to purify and keep things healthy.

Chicks will commence to scratch when they are but a day old, no difference whether they see the old hen scratch or not. If they are hatched in an incubator and reared in a brooder, they will scratch just the same. This proves that scratching comes by intuition and is nature's plan whereby fowls may get their living. It is a sensible thing to believe that fowls should be made to scratch for nearly all they eat. Scratching will tend to make them vigorous and prolific.

Violet Scent.

One of the most interesting product of the chemist's ingenuity—the artificial violet scent that has reduced the price of sweet violets considerably, and caused them to be sold at all seasons, i. e., "ionon"—is the cause of a very complicated patent decision. The difficulty of establishing the identity of method has been clearly shown during the lawsuits. The true inventor of "ionon" was the German chemist Tieman. In the year 1888 some chemists succeeded in isolating from backhausia an etheric oil, being characterized by a strong lemon scent; it was, therefore, called "citral." Three years later Semmler demonstrated the identity of citral with an aldehyde, previously discovered and named by him "geraniol." Citral may be obtained in various ways, and from it Tieman and Krüger derived a ketone, possessing a stale violet odor, which they named "pseudo-ionon." By intermolecular change from "pseudo-ionon," true "ionon" is developed, which possesses the true violet odor. Says Fielden's Magazine: There are, however, it appears probably three isomeric ketones having this scent. One of these is isolated from iris root, and they gave it the name of "irone," but in a subsequent experiment they obtained "ionon." At the same time, Messrs. Haarmann and Reimer, in conjunction with De Laire, had been working on a larger scale, starting from a decomposition of citral and employing a method by which they obtained "ionon," and which they patented." A manufacturer of essential oils, perfumes, etc., manufactured an artificial oil of violets, which he placed upon the market as his invention. The result has been a patent suit, in which there was the greatest possible difficulty in demonstrating the identity of the products and the methods employed for their production.

A MUSICAL BICYCLE.

At this time when so many improvements are being made on bicycles, in the way of attachable motors, etc., the machine illustrated herewith will doubtless interest our readers. It is the invention of Mr. Samuel Goss, of Chicago, and was designed for the purpose of furnishing music for the rider of the wheel and his companions, in order to break the monotony and give divertisement during long and tedious runs.

The mechanism, which is quite simple, is mounted on an iron frame made to fit into that of the machine. On this frame are stretched piano wires, *B*, while on the cross-piece, *A*, are some small hammers operated by pins on the cylinder, *C*, and made to strike the wires. The cylinder is rotated by worm gears placed at its left-hand end and driven from the crank shaft by a cord and pulley.

The inventor has foreseen the case when the riders

A MUSICAL BICYCLE

should tire of the music, by providing a small lever for throwing out the gears and thus stopping the cylinder. The tune may be varied by putting in new cylinders, and the time of any air may be quickened by increasing the speed of the wheel.

A TRAIN on the Ulster and Delaware Railway was stopped recently on account of the caterpillars which collected on the tracks in sufficient numbers to stop the train by the lubrication of the rails, which resulted from the crushing of their bodies under the wheels. According to The Railway Review, it is necessary for men to sit upon the cow-catcher and sweep away the obstructions by holding brooms on the rails.

New Processes for Sulphuric Acid.

A number of improvements have been recently devised in the manufacture of sulphuric acid, which promise to be of great importance in that industry. The first of these is now being used in Germany, and consists in the substitution of cast iron recipients for concentrating the acid for those constructed of platinum; the high price of the latter metal has led the manufacturers to look for a substitute, and it has been found that the cast iron recipients answer very well in cases where it is not necessary to have an acid absolutely free from iron. The iron used should be free from impurities and as hard as possible. In the process used, the acid is first concentrated in lead recipients to 61° Baumé, then introduced into the cast iron vessels, where it is further concentrated to 64°; it finally passes into two other concentrators, where it reaches 97° to 98° Baumé. The smaller recipients last three or four months and the large concentrators from six months to one year, the loss being less than that of platinum and the cost comparatively small. The second process, which is still more important, has been devised in England; in this the lead chambers are entirely suppressed, and nitrous vapors are used as an oxydant, the process resembling that which is now used for producing the Nordhausen, or fuming sulphuric acid. The Baden Anilin and Soda Works have perfected the system and applied it on a large scale in the production of ordinary sulphuric acid. The process is especially advantageous in the production of concentrated acid directly, thus doing away with the concentrating process; it gives an acid which is very pure and especially free from arsenic.

Chemical Food.

The deplorable food waste in our daily life is justly criticized and chemical research and industry are doing their best in devising chemical foods. The last few years have seen a number of artificial foods produced, but most of them are of no value to the poor. Chemists are becoming more and more anxious to find sources of nitrogenous foods. The artificial food industry is chiefly developed among the large concerns that supply dye stuffs, and employ a number of research-chemists. "Tropon" consists of one-third animal and two-thirds vegetable albumin. Another concern makes "Somatose," which is an albuminose, and has also brought out the more economical "Tannin" and "Milk Somatose," which may become very important foods for the masses. A dye-works makes "Nutrose," other concerns make "Plasmon," "Eukasin," "Sanose," and "Sanatogen," the latter being caseine compounds with sodium or ammonium.

Organic Bases in Baku Petroleum.

To isolate the basic nitrogen compound described by Schestakow, an experiment was carried out by G. W. Chlopin, in which 600 pounds of baku "masut" were agitated with 5 gallons of 15 per cent sulphuric acid for several weeks; from this was obtained, by supersaturation with alkali and extraction with ether, 0·005 per cent of a thick, oily, dark brown liquid, with a greenish fluorescence and an odor of pyridine. This basic product is sparingly soluble in water, but readily so in ether, benzene, alcohol, cold hydrochloric or sulphuric acid. It furnishes non-crystalline precipitates with the chlorides of platinum, palladium and cadmium, as well as with potassium ferrocyanide or bichromate; alcoholic solution of iodine gives a brownish precipitate. Analysis indicates a composition analogous to that of pyridine or quinoline, with 15 to 18 carbon atoms in the molecule. The examination of the platinum double salts revealed a series behaving like homologous members of a chemical group. Fine members have been isolated with molecular weights ranging from 104 to 309. Experiments on the toxic effect of the basic product on mammals, fish and bacteria lead the author to conclude that the poisonous action of crude petroleum is due to the hydrocarbons and allied derivatives rather than to the nitrogen bases present.

A New Comet.

Dr. William R. Brooks, director of the Smith Observatory, Geneva, N. Y., discovered a bright telescopic comet on the early morning of July 23. Its position was right ascension 2 hours 43 minutes 40 seconds; declination north, 12 degrees 30 minutes. It was in the constellation Aries, and has a northerly motion.

The comet is a beautiful telescopic object, resembling a great naked eye comet in miniature. It has a bright stellar nucleus and a broad tail. This is the twenty-second comet discovered by Dr. Brooks.

The Division of Vegetable Physiology and Pathology of the Department of Agriculture.

The Division of Vegetable Physiology and Pathology of the United States Department of Agriculture has done important work during the fiscal year ending June 30, 1899. One of the most important lines of work of the Division is that relating to nutrition. The science of plant pathology is rapidly crystallizing and there is nothing that will put it on a firmer basis than the study of the phenomena of life. The primary object of this work is to preserve and make useful the life of plants, and this can be done only when we fully realize the importance of the life functions themselves. After all, disease is only a manifestation of the loss of vitality and how to prevent this loss is a problem of the greatest scientific, as well as practical importance. Closely related to nutrition is the problem of heredity, and its bearing on the improvement of plants by breeding and selection. To breed scientifically the functions of the cell itself must be better understood, otherwise the work must be looked upon as more or less empirical.

No systematic attempt has been made in this country to investigate the many serious diseases of timber. As soon as the tree is cut it becomes subject to the attacks of many fungi which often cause serious loss. With a view of obtaining some preliminary data for use in inaugurating more extensive investigations, an agent has been appointed to study some of the more important diseases affecting timber. Field studies of some of the more destructive diseases are being made and information is being gathered which will be of use in determining the line of work looking toward the prevention of the troubles. A study of the diseases of forest and shade trees is closely related to the work on the diseases of timber. Some more or less preliminary studies have been made of the diseases of trees, and it is planned to extend these investigations. The diseases are, as a rule, of such a nature as to necessitate much painstaking work to discover their cause, many of them being produced by unfavorable surroundings, such as improper soil, or food, or the presence of noxious substances. To determine the cause, and the combinations of the influences at work in such cases, is usually a great problem.

Special investigations have been made relative to the little peach disease, and to diseases of pomaceous and other fruits. Studies were also made on the diseases of truck and garden crops, and important results have been obtained in the treatment of a number of diseases of the Irish and sweet potato. The work on plants under glass has been continued and a number of interesting conclusions were secured. The diseases of violets, carnations and roses, have received special attention, as also the diseases of such crops as lettuce, tomatoes and lemons. This Division has from time to time received complaints relative to the serious diseases of cotton in various parts of the South, especially the one affecting the Sea Island cotton grown off the coast of South Carolina. This cotton is exceedingly valuable and the lands on which it can be grown successfully are in great demand. It has already been shown that the trouble is due to a fungus which attacks the roots of the plants and occurs not only on cotton, but also on other crops when grown in the infected soil. This fungus has great vitality and may live in the soil for years and attack cotton when again planted there. An assistant is making studies with a view to breeding cotton which will have for its object the improvement of varieties now grown both as regards marketable qualities and the ability to resist various diseases. Various facts have been obtained relative to cereals and cereal diseases and extensive work on the curing and fermentation of tobacco has been inaugurated, the investigations being carried on in co-operation with the Division of Soils. The primary object of the work is to obtain, if possible, the cause of the peculiar flavor and texture of different kinds of tobacco and the possibility of controlling these in the finished product.

Some important advances have recently been made in the use of pure yeasts for the production of grape, apple, berry and other wines. Ordinary fermentation in the juices is brought about by the organisms occurring on the fruits themselves, and these organisms are often of such a nature as to seriously interfere with the production of high-class wines. By using a large quantity of yeasts known to be pure, the difficulties resulting from the presence of undesirable organisms can be overcome. Some yeasts were obtained in Germany and preliminary experiments were made to determine their effects on the fermentation of cider. The different forms of yeasts were found to possess distinctive characteristics as far as the production of flavor and bouquet are concerned. Experiments have also been inaugurated with a view to determining the affection of the accumulation of copper in the soil, copper sulphate forming the basis of nearly all fungicides used.

Considerable time was also devoted to the inspection of plants and seeds introduced from various countries for the purpose of distributing them in this country. It is, of course, of the highest importance that all plants and seeds brought in in this way shall be carefully inspected and, if necessary, treated so that no serious fungus or other parasite may be destroyed with them. Special attention is paid to plant breeding and further work was carried on with hybrid citrous fruits. The walnut crop of California was investigated and it was found that the vine disease, which has been more or less prevalent in Southern California for a number of years, can be kept in check by grafting on certain kinds of roots which are resistant to the disease, and the crossing of raisin grapes has now gone sufficiently far to warrant the statement that time and judicious crossing are all that are necessary to obtain a hardiness of the plant and the fruit qualities required in California, Arizona and Nevada to withstand the cold spring winds.

A sub-tropical garden at Miamee, Fla., has been placed at the disposal of the Department, and contains about six acres. The plan is to use this garden in making preliminary tests of hybrid fruits, etc. On the ground is a well-equipped laboratory, which was erected free of cost to the Department.

The Division, of course, bears its part in the correspondence and lectures of the Department. B. T. Galloway, Esq., is the Chief of the Division of Vegetable Physiology and Pathology.

The Current Supplement.

The current SUPPLEMENT, No. 1283, has many articles of unusual interest. "The Electrical Tower at the Pan-American Exposition" is accompanied by a full-page engraving. There are also illustrations of the park lake and two of the buildings. "Transmitter Using the Sine Wave for Cable Telegraphy," by Crehore and Squier is an elaborate article, fully illustrated, describing this remarkable instrument. The "American Engineering Competition," III., deals with the heavy iron and steel trade. "Some Twentieth Century Problems" is by William Trelease. "The German Antarctic Exposition" is described at considerable length. "A Votive Adze of Jadeite from Mexico" is an interesting archæological article. "Tycho Brahe" is a very full article on the early Danish astronomer.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

SULKY ATTACHMENT FOR HARROWS.—LEON D. HOWARD, Marston, S. D. This attachment is so constructed that it can be turned from side to side as occasion may demand, without exerting corresponding influence on the harrow. Only a single wheel is needed. The driver is seated close to the team, enabling him easily to control the animals. Since the horses are harnessed by whiffletrees to the tongue or pole, the driver is out of the dust. The attachment can be applied to any harrow; and when applied, will cause the harrow to draw much more easily than the customary harrow.

PLOW.—JAMES A. FREEMAN, Belleview, Fla. The stock is so constructed that cutters, sweeps, cultivator-blades or shares, and the like can be flexibly or adjustably applied thereto, so as to accommodate the plow to any character of soil. A landside is provided which is attached to the stock. Sweeps or like blades can be adjustably secured upon the landside. When the landside and stock are connected with the beam and handles, the plow will operate close to a line of fence.

CULTIVATOR ATTACHMENT.—HENRY T. CROSBY, Coleman, Tex. The device can be conveniently attached to the standards or footpieces of any cultivator, and holds different numbers of small plows or harrow-teeth for the cultivation of any crops, or for use at any place where a small harrow is needed. It is of light and simple construction, so that it can be cheaply made.

COW-MILKING MACHINE.—MODESTUS J. CUSHMAN, Waterloo, Iowa. The inventor has devised and put in successful practical use a milking-machine in which suction and traction are applied to the animal's teats, and in which the vacuum in the teat-cups is made alternately to increase and decrease, thus closely imitating the action of a calf's mouth, without injury to the teats or annoyance to the animal, so that a larger yield of milk is obtained.

SEED-COTTON CLEANER AND FEEDER.—VANDER H. TALTON, Columbus, Ga. This apparatus is designed to remove foreign substances from seed-cotton and at the same time to even and feed the cotton uniformly to the gin. Heretofore an endless traveling apron has been employed in connection with one or more toothed cylinders and a screen arranged under one of them for separating the foreign matter. Mr. Talton dispenses with the apron and employs in place of it a rotatable cylinder having tangential teeth. The cylinder is arranged in connection with another, more rapidly rotated, toothed cylinder, whereby the apparatus is reduced in size, made less expensive and more efficient.

Mechanical Appliances.

BOTTLE-FILLING MACHINE.—SAMUEL C. MILLER, Louisville, Ky. The invention provides a bottle-filling machine which employs a vertically-movable liquid-holder; spaced filling-tubes depending therefrom to enter the necks of bottles placed beneath the tubes to receive liquid; and means to cut off the flow of liquid when the bottles are filled. The liquid is accurately controlled, while passing into one or more bottles. The machine is devoid of all complicated parts and is very efficient in its operation.

BOILER-TUBE SCRAPER.—WORTHINGTON H. INGERSOLL, Hamburg, N. J. The scraper belongs to that class in which a shank carries a series of spring-pressed arms provided with cutting-blades or cutting edges. The inventor has improved the cutting-blades; provided a stronger construction of shank; given the arms a strong support when closed, so as to prevent the breaking of the rivets by which the arms are pivoted to the shank; and constructed the tool so that the scale and dirt will find a ready exit and will not interfere with the pivotal movements of the arms.

MACHINE FOR MAKING FIREPROOF COVERINGS FOR WALLS OR CEILINGS.—PATRICK RYAN, Manhattan, New York city. This machine comprises an elongated supporting-frame having a table on its upper portion; a holder, for liquid coating material, having compartments; a mixing-tank for the liquid coating material, adapted to supply the holder compartments; and a number of paper-sheet carriers, arranged in sequence over the table and from which elongated webs of paper may be extended over one another to rest upon the table. The escape of the liquid from the holder-compartments upon the sheets is readily controlled. The coating material is evenly and thinly distributed as the sheets are moved on the table. A device perforates and scallops each paper-sheet. All the coated sheets are compressed together, thus forming a continuous plaster-board. The compound web is cut into sheets or completed plaster-boards, as it approaches the discharging end of the machine.

Railway Contrivances.

SEAL-LOCK.—CHARLES A. RASCO and JOHN T. TAYLOR, Americus, Ga. This seal-lock for freight-car doors has a casing in which a hook-latch is mounted to swing in the casing; and a hook-bar is designed to be attached to the car-door and to be engaged by the hook-latch. An arm is extended outward from the hook-latch through a slot in the casing; and a lug on the arm has a recess to receive one end of a seal. A keeper-block is mounted to rotate on the casing and has a recess to receive the other end of the seal. A rotary movement of the block while engaging the seal is prevented. The seals are made of glass and hence are very cheap.

LOCOMOTIVE-EXHAUST AND MEANS FOR REGULATING DRAFT.—WILLIAM H. PRENDERGAST, 416 Montgomery Street, Savannah, Ga. With the smoke-box an exhaust steam passage communicates, an independent passage being provided for the exhaust-steam. Two rocking-valves are applied to these passages, which valves are mounted upon shafts on which spur-gears are keyed. An intermediate gear meshes therewith; and a lever-mechanism operates the intermediate gear, whereby the oscillation of the intermediate gear effects the opening and closing of the valves. The draft may be left unaffected, while exhaust-steam is allowed free independent discharge. The amount of exhaust-steam permitted to enter can be regulated by adjusting the valves.

Miscellaneous Inventions.

BIT-GUIDE.—FREDERICK A. LAMBERG, Hot Springs, Ark. The invention provides a mechanism which is small and easily transported, which can be secured to the side of a bench or table, and which will serve for accurately guiding a boring-bit and brace, so that a series of holes can be bored at the same angle or a hole can be bored at any desired angle.

BUCK-SAW.—CHARLES T. REDFIELD, Glenhaven, N. Y. The saw comprises opposite frame-bars between which an arch-bar extends, curved upwardly from end to end. A continuous brace-bar overlies the arch-bar and is made straight, and rigid at its center with the arch-bar at the crown of the latter. The brace-bar can be secured positively to the frame-bars at the ends of the brace-bar. The longitudinal tension exerted on the saw-blade operates longitudinally on the straight brace-bar to hold the arch-bar from moving up between the frame-bars and thus increases the rigidity of the saw.

ANCHOR-IRON.—WALTER R. MADISON, Springfield, Mass. The anchor-plate is adapted to be set in a wall and is provided with an eye. The joist has on its top between the ends an upwardly-extending hook arranged to engage the eye. The anchor-iron is applicable to the ends and sides of a floor and joists and is arranged for holding the joists securely in place on the supporting-walls, but in such manner that, should the joist break or be turned over or otherwise give away, it will readily fall without pulling down the structure.

EYEGLASS-HOLDER.—CARL F. KABISCH, Manhattan, New York city. This holder is so constructed that the eyeglasses can be instantly brought into position for use and as quickly returned within their case, both operations being accomplished by the movement of the thumb of the hand in which the holder is held.

INK-WELL.—OWEN V. FARRELL, Deposit, N. Y. The well comprises a body-portion and a neck-portion. In an opening in the top of the body-portion a bulb is arranged. The neck-portion is provided with a cover. By pressing on the bulb, the cover is swung up and ink forced up the neck-portion. Upon removing pressure from the bulb, the cover drops and the ink sinks.

THEATRICAL APPLIANCE.—CLAUDE L. HAGEN, 542 W. Twenty-sixth Street, Manhattan, New York city. This stage appliance, giving one the illusion of an object passing over a surface (ground, water, ice), is particularly adapted for use in horse or chariot races. The inventor employs a number of narrow endless belts or aprons, arranged on the floor of the stage, between which, chariots and other objects which are supposed to be moving, are placed. The belts are painted to represent the ground over which the chariots run, so that when the belts are driven, it appears to the spectators as though the chariots were actually moving rapidly over the ground. The appliance contributed considerably to the success of the play, "Ben Hur," presented in New York. In an early issue we purpose to give a more extended description.

CHEESE-CUTTER.—WALTER G. DOTY, Middletown, Ohio. The invention provides a machine by means of which any desired amount can be cut from a cheese by a very little power. A simple means is provided for determining the proper position for cutting off a desired weight of cheese.

ATTACHMENT FOR OIL-CONTAINERS.—WILLIAM L. CLAYTON and NEWTON R. PERSINGER, Central City, Neb. The invention relates to a device for filling lamps and the like from a can or barrel. The oil is forced out by air-pressure. A valve-chamber communicates at its middle with a tube or hollow column. One end of the valve-chamber is open to the atmosphere; and the other end communicates with air-pressure devices. A valve is mounted to reciprocate in the valve-chamber and is movable over the mouth of the tube or hollow column, the valve seating in either end of the valve-chamber and serving alternately to place the tube in communication with the air-pressure devices and with the atmosphere.

GATE.—TOBIAS BEARD, Columbiana, Ohio. Simple mechanism whereby a gate can be opened and closed by a person while sitting in a vehicle, forms the subject of this invention. The gate is mounted to swing upon a pivot-bar. An opening-bar is provided, which has arms from which ropes or cables extend. On the bar is a cross-head. Levers are pivoted on the forward end of the gate and are connected by draw-rods with the cross-head. Spring-latches are operated by the levers.

FIREPROOF-SHUTTER.—EMILE F. VERDEL and FELIX L. SAINO, Memphis, Tenn. This metal shutter consists of two spaced corrugated metal plates, the corrugations of one plate being disposed at an angle to those of the other. A fireproof lining is located between the plates and in contact therewith at intervals only, so as to leave on each side of the lining air-spaces running in different directions. The construction renders warping impossible.

COLLAPSIBLE SHIPPING-CRATE.—ZACHARY T. STOCKS, Everett, Wash. The box comprises a front, a rear side, and a bottom hinged to the front and having a sidewise hook connection with the rear side. A cover or top is hinged to the rear side. Spring-pressed catches are pivoted on the front and are adapted to swing into engagement with keepers on the top. Ends are hinged to the front and to the rear side, each made in sections hinged together.

TOBACCO-HOLDER.—WILLARD P. SMITH. Manhattan, New York city. It is the usual practice to wrap chewing-tobacco in tin-foil; and when so wrapped, it becomes dry and practically useless in a very short time. The present invention provides a package or holder practically air-tight when closed, thus preventing the escape of the tobacco's moisture, and so constructed as to permit the forcing out of a quantity of tobacco whenever desired.

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7926) W. S asks: 1. Why is it that the image on the ground glass of a camera appears upside down? A. Because the rays of light cross as they pass through the opening of the lens. Take the lens off from the camera, put in its place a piece of card through which a small hole has been made and you will see the picture inverted in the same way. The rays from the top of an object pass in a straight line through the hole and must go to the bottom of the ground glass. So too rays from the bottom of an object go to the upper part of the ground glass. The picture is inverted up and down and right and left. 2. Are there any cameras on the market, that have devices so that the image appears right side up? A. No. A right angled prism could be attached to the lens so as to erect the picture, but it is not worth while. 3. What solution combined with a solution of ferric chloride will make a green solution? A. Ferric chloride in solution will become green by combining it with any solution of a sulphate which by metathesis will produce ferric sulphate. 4. Is there any book on navel orange growing? A. The SCIENTIFIC AMERICAN, vol. 82, No. 21 contains an article on the navel orange. We can send it to you for ten cents.

(7927) C. D. R. asks: Can you give me a receipt for transparent etching ground, for retouching? Silicate of soda is transparent, but leaves a ragged edge in the lines. Is there anything I could add to it for the purpose that would not destroy its transparency? A. Retouching varnish, Sandarac 1 oz., Castor oil 80 grains, Alcohol 6 oz.

(7928) F. C. asks: How can I cover a pulley with paper or leather? Pulley is of cast iron 9 inches by 8 inches with an extra smooth face. A. Scratch the face of the pulley with a rough file thoroughly, so that there are no bright or smooth places. Then swab the surface with a solution of nitric acid, 1 part; water, 4 parts; for 15 minutes; then wash with boiling hot water. Having prepared a pot of the best tough glue that you can get, stir into the glue a half ounce of a strong solution of tannic acid, oak bark or gall nuts, as convenient to obtain, to a quart of thick glue; stir quickly while hot and apply to the paper or pulley as convenient, and draw the paper as tightly as possible to the pulley, overlapping as many folds as may be required. By a little management and moistening of the paper, it will bind very hard on pulley when dry, and will not come off or get loose until it is worn out. Use strong hardware wrapping paper.

(7829) DeF. H. asks: 1. How many volts and amperes does the simple plunge battery described in "Experimental Science" give? A. Each cell gives an average of 1·8 volts, so that in series you would have 1·8×8 or about 14 volts. In parallel it will give 1·8 volts. The amperes depend upon the external resistance principally, since the internal resistance is very small. You can safely take 4 amperes. 2. How long can this battery be used without decreasing in strength? A. Any battery begins to be exhausted as soon as it begins to do work, of course. You will obtain about 60 ampere hours from the battery, before renewing the solution. The zincs will last a long time, the carbons indefinitely. 3. What would the materials for this battery cost (approximately)? A. If you can make the case, windlass, etc., the cost is much reduced. The jars, plates, and other materials, will cost about $15. 4. Directions for making a small and inexpensive Ruhmkorff induction coil giving a 1 inch spark, for use with the two chromic acid cells? A. You will find the directions, full instructions with drawings, in Bonney's "Induction Coils." Price by mail, $1. The coil described in "Experimental Science" is a good one, and gives a longer spark. It will cost but a little more than one giving an inch spark.

(7930) L. E. T. writes: Steel being a conductor of electricity, why is it that the steel balls used in the coherer of a wireless telegraph system, being in contact with one another as they are, do not make a continuous circuit in the receiving apparatus. A. Steel balls in the ordinary sense of the word have not been used in the coherer of the wireless telegraph so far as we are informed. The coherer contains a powder, composed of metal filings. Various metals have been employed simple or mixed. Any powder, even of a conductor, is a very poor conductor. The principal reason is that the particles are *not* in close contact with one another. When an electric wave strikes this powder, its electrical resistance is very greatly reduced, as if the particles had cohered. This state continues till a jar is given to the powder, when the high resistance is restored. See Fahie's "History of Wireless Telegraphy." Price $2 by mail.

TO INVENTORS.

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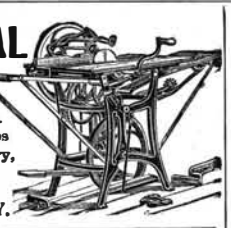

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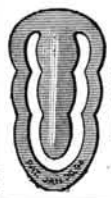

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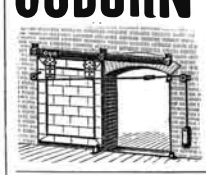

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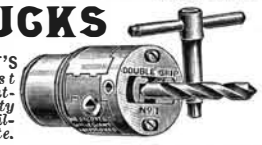

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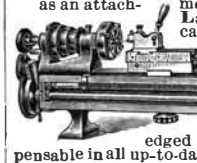

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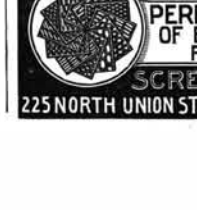

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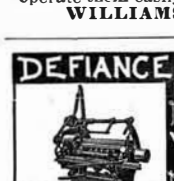

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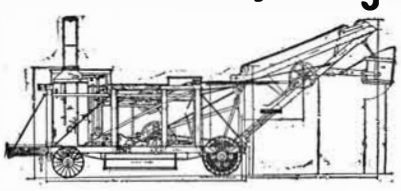

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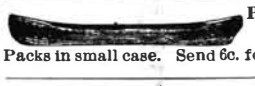

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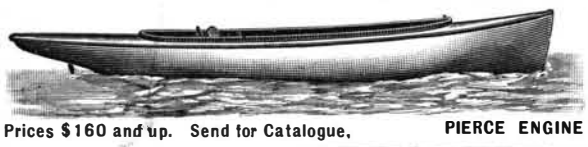

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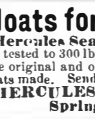

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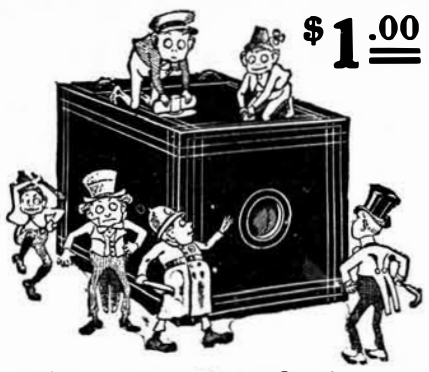

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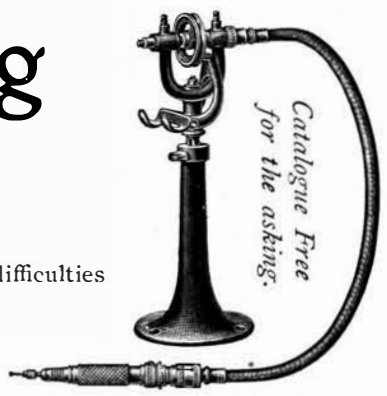

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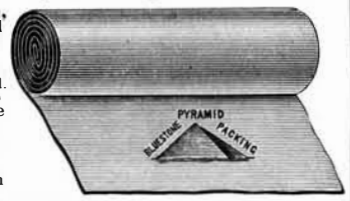

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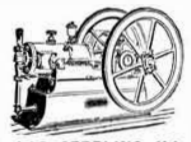

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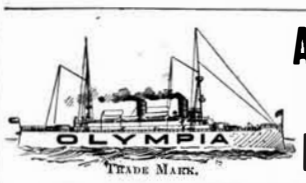

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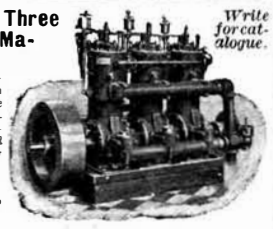

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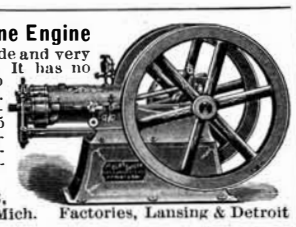

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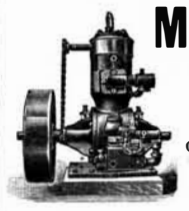

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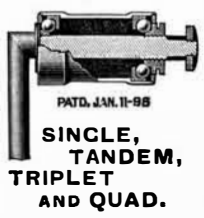

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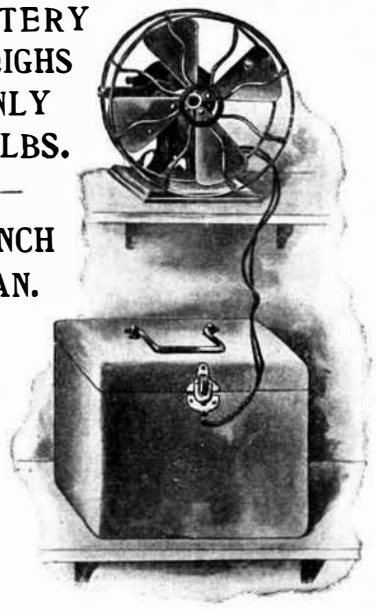

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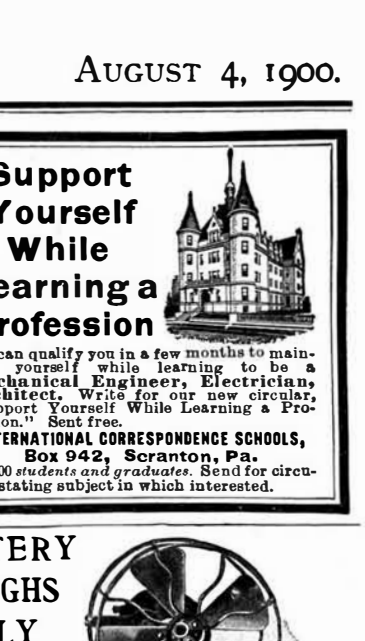

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